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# RESEARCH
# and
# FARMING

## 1942

OCTOBER 3 1889

Agricultural Experiment Station
North Carolina State College of Agriculture and Engineering
of the
University of North Carolina

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# RESEARCH AND FARMING

# 1942

I. O. Schaub
Dean of Agriculture

L. D. BAVER
Director of Agricultural Experiment Station

Sixty-fifth Annual Report
of the
Agricultural Experiment Station
North Carolina State College of Agriculture and Engineering
of the
University of North Carolina
For the Fiscal Period July 1, 1941 to June 30, 1942
Progress Report for the Period December 1, 1941 to
November 30, 1942
Raleigh

# STATE INSTITUTIONS COOPERATING IN AGRICULTURAL RESEARCH

State College of
Agriculture and Engineering
of the University of North Carolina

**FRANK A. GRAHAM,** *President*
**J. W. HARRELSON,** *Dean of Administration*
**I. O. SCHAUB,** *Dean of Agriculture*

N. C. Department of Agriculture
Raleigh, N. C.

**W. KERR SCOTT,** *Commissioner*
**F. E. MILLER,** *Director of Branch Stations**

---

*The six branch station farms are owned and operated by the North Carolina Department of Agriculture, and the employees on these farms are members of the Department of Agriculture staff.

# COOPERATION WITH THE UNITED STATES DEPARTMENT OF AGRICULTURE AND OTHER FEDERAL AGENCIES

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Division of Cotton Marketing

## BUREAU OF AGRICULTURAL CHEMISTRY AND ENGINEERING

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Food Research Division
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## BUREAU OF ANIMAL INDUSTRY

Animal Husbandry Division

## BUREAU OF DAIRY INDUSTRY

Division of Dairy Cattle Breeding, Feeding, and Management

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Division of Cotton and Other Fiber Crops and Diseases
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AMERICAN POTASH INSTITUTE

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"Correlation of Soil Fertility Levels as Determined by Short Chemical Tests with Fertilizer Response on Cotton and Peanuts."

CROP PROTECTION INSTITUTE

"Peanut Leafspot Studies."

E. I. DUPONT DE NEMOURS CO.

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"Peanut Root Rot Studies."

TENNESSEE CORPORATION

"Peanut Leafspot Studies."

U. S. RUBBER COMPANY

"Study of the Suitability of Certain Organic Compounds as Seed and Soil Treatment Materials."

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*To the Governor of North Carolina, the Board of Trustees and President of the University of North Carolina and the Dean of Administration of the North Carolina State College of Agriculture and Engineering:*

I am transmitting herewith the report of the Agricultural Experiment Station for the year ending June 30, 1942.

*Respectfully submitted,*

L D Baver

Director,

NORTH CAROLINA AGRICULTURAL EXPERIMENT STATION.

# Your Experiment Station Goes To War:

Food is a weapon of war, as essential and as effective as guns. Just as the ordinary soldier is the backbone of an Army's operation, so is the ordinary farmer the backbone of agriculture's vital part in food production for the war effort. The key to food production is in the hands of farmers. They are now doing their best with the resources at their disposal. The job of farming in war time, like the job of war itself, consists in making the most effective use of all available means—labor, machinery, fertilizer, facts.

Even as a soldier must depend upon someone to design and build the weapons that he uses, so must the farmer look to someone to design the weapons of food that he produces. This designer is his Agricultural Experiment Station. His Experiment Station has as its job the application of science to the problems of food, fiber and oil production, in the same way that the designer of guns uses science to achieve his objective. If he needs the most disease-resistant and highest yielding variety of a crop, he finds it designed by the Station plant breeders. If he requires labor-saving machinery, the Station agricultural engineers produce the design. If he is confronted with the control of plant diseases and insects, he obtains the design from the Station pathologists and entomologists. If he must know the most efficient method of fertilization of his crops, the design comes from the Station agronomists. If he must have the knowledge to produce livestock and poultry, he turns for sound specifications to his Station designers in these important fields.

North Carolina soils, tilled by North Carolina farmers, using facts from the North Carolina Agricultural Experiment Station which are carried to them by the North Carolina Agricultural Extension Service, are making their contribution to the national war production in amounts never before known in the history of the State. From the potatoes and vegetables that are produced just a few feet above sea level in Eastern North Carolina to the beef cattle and sheep that graze on the highest mountains in Western North Carolina, patriotic and hard-working farmers, equipped with the latest facts coming from research, are handling their soils to obtain maximum production.

Your Agricultural Experiment Station has gone "all out" in an effort to find out the facts and design the specifications that will make the maximum contribution to food production in the war effort. Ninety per cent of its projects have been revised to answer some wartime problem. This compares with an average of seventy-seven per cent for all of the Experiment Stations of the country. Thirty-two capable and energetic scientists have gone to war, as they have been drafted from essential projects. This has meant an increased load on those remaining. Yet, the determination and enthusiasm of those remaining have made it possible to carry on without any serious losing of vital ground.

Just how has your Experiment Station gone to war? This annual report of the accomplishments of the Station during the first year after Pearl Harbor will show the food production facts that have been obtained. However, let us make a tour of inspection of the various departments and look at just a few of the products of their efforts.

### Department of Agricultural Economics

Facts on the farm labor problem are rapidly being gathered so as to present the true picture of North Carolina's labor needs in the food production program.

Analysis of all the information available on North Carolina farms to establish a sound basis for the establishment of food production goals and capacity production for 1945.

### Department of Agricultural Engineering

A "Once-over" fertilizer distributor and planter has been designed that does the work of six men and six mules and also places the fertilizer to the side of the seed, thereby increasing germination and yields.

Dehydration studies have been initiated to produce the facts for the dehydration program throughout the state, so that North Carolina fruits and vegetables can be sent to our armed forces abroad. (In cooperation with Horticulture.)

### Department of Agronomy

New facts on how to fertilize peanuts on different soils as well as new information on peanut culture are now being found that will mean increased yields per acre at no extra cost.

Soybean varieties for maximum oil production and adapted to the various sections of North Carolina are being tested for immediate release.

Hybrid corn and small grain research are producing the facts for increased grain production which is so essential for livestock and poultry.

Facts on hays and pastures for livestock feed are producing green fields from the mountains to the sea.

### Department of Animal Industry

Facts on how to grow beef on reeds in Eastern North Carolina, barley and lespedeza in the Piedmont and bluegrass in the mountains are adding many pounds to our critical meat supply.

The control of mastitis and the production of milk through the use of sweet potato, sorghum, soybean, small grain and corn silage are helping to meet the acute shortage of milk throughout the entire state.

Studies on the conservation of the nutritive value of sweet potatoes, pork and butter are underway to provide information for the armed forces and the civilian population as well.

### Department of Botany

The control of the peanut leafspot disease through dusting and of seedling diseases through seed treatment is increasing peanut yields by nearly 30 per cent.

New investigations have been started on the control of soybean and vegetable diseases.

### Department of Experimental Statistics

Efficient designs for the experiments of other departments have been developed to help give the most reliable results in the shortest time, with the least amount of labor and cost.

Analyses of the results of the experiments of other departments are being made to permit these departments to keep up-to-date on all their work.

### Department of Horticulture

Methods for the brine preservation of vegetables have been developed which will make it possible to preserve these vegetables without the use of critical tin or sugar.

Sweet potatoes have been grown for silage. This type of silage has been shown to be equal to corn silage. It can be produced in large tonnages in the Coastal Plain (in cooperation with Agricultural Engineering and Animal Industry).

Various rubber and drug plants are being tested for their adaptability to North Carolina conditions.

### Department of Poultry

Crossbreds for broilers have been developed which produce more rapid gains with the same feed.

Poultry disease research is decreasing the mortality in poultry flocks, thereby adding to production.

### Department of Rural Sociology

Certain phases of the farm labor problem are being handled in conjunction with the work in Agricultural Economics. The type of farm labor supply is being established for each section of the state.

Neighborhood leaders studies are contributing to the problems of putting across state and national programs in the farm community.

### The Soil Research Laboratory (Wilmington)

The application of soil research to the answering of specific soil fertilization problems is saving many tons of essential fertilizers and increasing food production.

Crop quality is being improved through the use of minor elements in the farmers fertilizer.

### Department of Zoology and Entomology

The war has practically eliminated many of the standard insecticides. Substitute materials are being tested in order to be able to control insect pests.

The control of insect pests on vegetable, truck and fruit crops as well as stored feeds and foods, is adding to the amount of food that the civilian finds in the grocery store.

### The Branch Stations

The Animal Science and Crops Research Farms near Raleigh and the six outlying Branch Stations (operated in cooperation with the Department of Agriculture) are beehives of activity for war projects. Most of the field experiments are carried out on these farms. Labor and machinery shortages are hampering these activities, but good results will be forthcoming.

This brief tour of inspection should make it clear that the North Carolina farmer does have the benefit of the latest sound facts to help him meet the challenge of increased food, fiber and oil production. Let every farmer use the best facts to get the most efficiency out of his labor, his machinery, and his supplies, in his all-out production program for victory!

L. D. Baver,
*Director.*

# AGRICULTURAL ENGINEERING

### A New War Machine for the Fighting Farm Front

Southern agriculture's newest farm machine, the "Once-Over Fertilizer Distributor Planter," developed by the N. C. Agricultural Experiment Station, is now being manufactured by John Blue Co., of Laurinburg, N. C.

Savings in labor and power, more efficient use of fertilizer, and increased yields make this machine definitely a war machine. It was designed for the one-mule farmer, to aid him in his fight to help put over the food front which has been made serious by shortages in labor, fertilizer, and machines. (See figure 1.)

The "Once-Over" was designed for the Coastal Plains but is well adapted to other areas. To illustrate the value of this machine to agriculture in North Carolina if the 470,407 acres of cotton that are planted and fertilized each year in the Coastal Plains were planted with the "Once-Over," approximately 1,281,000 man hours of labor would be saved. This would be accomplished during one of the busiest seasons of the year and at a period when success or failure of

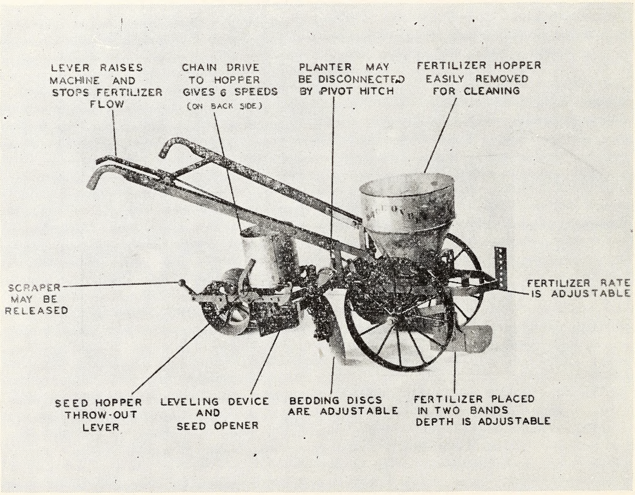

LEVER RAISES MACHINE AND STOPS FERTILIZER FLOW
CHAIN DRIVE TO HOPPER GIVES 6 SPEEDS (ON BACK SIDE)
PLANTER MAY BE DISCONNECTED BY PIVOT HITCH
FERTILIZER HOPPER EASILY REMOVED FOR CLEANING
SCRAPER MAY BE RELEASED
FERTILIZER RATE IS ADJUSTABLE
SEED HOPPER THROW-OUT LEVER
LEVELING DEVICE AND SEED OPENER
BEDDING DISCS ARE ADJUSTABLE
FERTILIZER PLACED IN TWO BANDS DEPTH IS ADJUSTABLE

FIG. 1. THE ONCE-OVER FERTILIZER DISTRIBUTOR AND PLANTER.

the crop may depend on getting the seed in the soil at the right time. Further economy is affected by placing the fertilizer in bands to the side of the seed rather than under the seed. This would increase the yield to 45,000 bales of lint cotton and 22,700 tons of seed. Furthermore, replanting caused by seed injury from the fertilizer would be very low. This would materially increase the above labor saving figure. Similar savings may be expected in the planting of tobacco, corn, peanuts and soybeans. Taking the combined acreage of these crops, and including cotton, the Coastal Plains Area may be expected to save 7,500,000 man hours of labor annually. This would be a tremendous help to the war effort. Considering the savings in labor and seed cotton and the increased production, millions of dollars would be added to the farmer's income.

An important feature of the machine is the ease with which the hopper on the distributor is cleaned of fertilizer. Cleaning the hopper at the end of the season will minimize the corrosion effect of the fertilizer on the metal. Thus costly repairs would be reduced and vital metal would be conserved.

Only approximately 150 pounds of steel is required to build the "Once-Over." This is less steel than normally goes into the manufacture of the machines commonly used in the present practice of fertilizing and planting. The Coastal Plains Area should have several thousand of these machines. Steel thus invested would represent war time economy at its best.

### A Harvester for Sweet Potato Vines

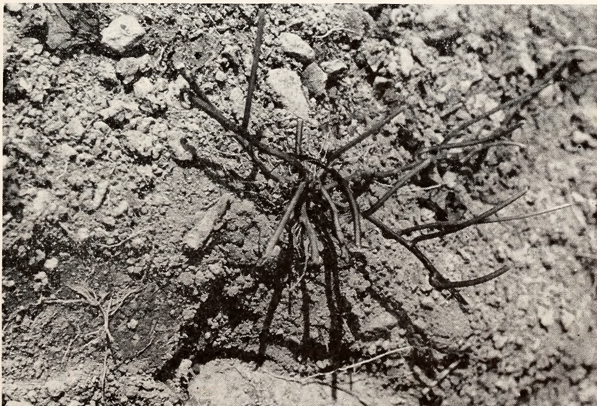
A machine which cuts, rakes and dumps sweet potato vines in convenient piles has been developed. Figure 2 shows a sweet potato plant after the vines have been removed. The present machine is as yet on an experimental basis and certain changes must be made, based on experience already gained. The development of such a machine will increase the value of the crop, afford an opportunity for expanding the acreage planted, preserve a crop by-product which is now lost and provide more livestock feed.

### Farm Wastes Make Good Insulation

A study of the insulating properties of various farm waste materials revealed that every farm

(Continued on Page 16)

FIG. 2. VIEW OF SWEET POTATO PLANT AFTER REMOVAL OF VINES BY CUTTER.



# FIELD CROPS

## Corn

### Types of Hybrid Corn Explained[1]

Many individuals misinterpret the term "hybrid" as applied to corn. The term is commonly taken to be a specific name for a variety of corn. A discussion of types of hybrids therefore seems worthwhile here to aid the reader in following the work given later. Since a hybrid of any organism is the progeny resulting from the crossing of two distinct parent strains, it is obvious that many different hybrids can be produced. Inbreeding in corn for several successive generations results in the establishment of "inbred lines," each of which are distinct strains. When two inbred lines are crossed, the first generation is known as a "single-cross hybrid." The cross of one inbred and an open-pollinated (farmer's) variety is designated as a "top-cross" or 'inbred-variety hybrid." A single-cross hybrid crossed with an open-pollinated variety produces a "single cross-variety hybrid." Crossing of two different single-cross hybrids gives rise to the "double-cross hybrid." The major portion of hybrid corn grown in the United States is from double-cross hybrid strains because of certain advantages this type of hybrid has, especially in seed production.

### Home Production of Hybrid Corn Seed[1]

Many farmers can produce hybrid corn seed on their farms thereby eliminating the high cost of hybrid seed when bought each season. A small group of growers have produced their own hybrid seed during 1941 and 1942. A cooperative program between the N. C. Experiment Station and the N. C. Crop Improvement Association makes it possible for farmers to buy foundation seed stocks. In addition to foundation seed the grower is given instructions as to planting, crossing by detasseling, harvesting and care of the hybrid seed. An apprenticed year is required to acquaint the grower with the various steps in hybrid seed production. Only a ¼ acre seed block is grown during the apprenticed year. The apprenticed blocks have averaged 5 to 7 bushels of hybrid seed. On the quarter acre a

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[1] Cooperation: Bureau of Plant Industry, U. S. Department of Agriculture.

[1] Cooperation: Bureau of Plant Industry, U. S. Department of Agriculture.

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(Continued from Page 15)

is a potential source of fill-type insulating material. Shredded corn stalks and husks are quite valuable insulators. Pine straw, wheat straw, oak leaves, and sawdust are also good insulators in the order named, pine straw being the best.

The best fill can be secured by running the rough material through a ¾-mesh screen on a hammer mill. This grinding reduces the bulkiness, increasing the density with a corresponding increase in insulating value. If ground too fine, the insulating value is reduced.

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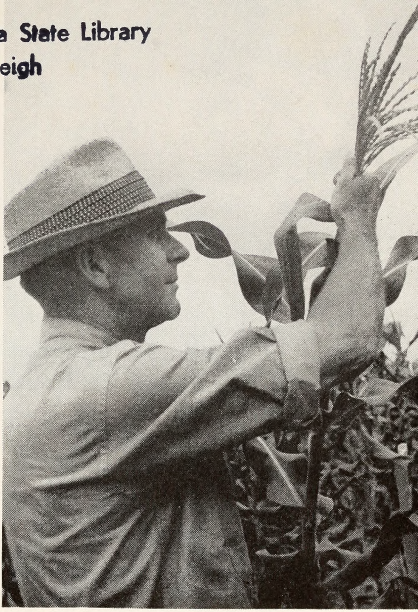

FIG. 3. MR. W. T. MOSS, YOUNGSVILLE, IS SHOWN PULLING A TASSEL FROM ONE HYBRID SEED BEARING PLANT IN HIS 1942 APPRENTICED HYBRID CORN SEED BLOCK. NOTICE HOW HIS HAND IS PLACED AROUND THE BASE OF THE TASSEL TO INSURE COMPLETE REMOVAL OF ALL THE TASSEL PARTS. (PICTURE BY L. S. BENNETT).

return of $20 to $30 can be figured for the extra work involved based on present prices of hybrid corn seed. The urgent work comes in late June or July when all tassels in the seed bearing rows must be pulled by hand (see figure 3).

### Farm Trials With Hybrid Corn Strains Prove Valuable[1]

Farmers reported varying success with the hybrids on trial in 1942. The same hybrid strain was not always the best under varying local farm conditions. The failure of one hybrid to be universally good was also shown in the North Carolina Official Hybrid Corn Tests conducted at six locations across the state. The growers in 1942 have reported average increases in grain yield of 15 to 30 per cent for the best hybrid strains as compared with the local varieties. Over a four-year period Experiment Station tests have shown an average of 15 to 20 per cent more grain for such hybrid strains than for the local varieties. These hybrid strains are known technically as single cross-variety hybrids. The single cross foundation seed was developed by a state experiment station (not this station), or by the U. S. Department of Agriculture, while the variety in each case is of local origin. In Pitt County where drought was severe in 1942 the 5 yellow hybrid strains averaged 35.3 bushels per acre, while the local variety produced 17.3 bushels per acre. Early maturity of the hybrid strains and other drought resistant character-

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[1] Cooperation: Bureau of Plant Industry, U. S. Department of Agriculture.

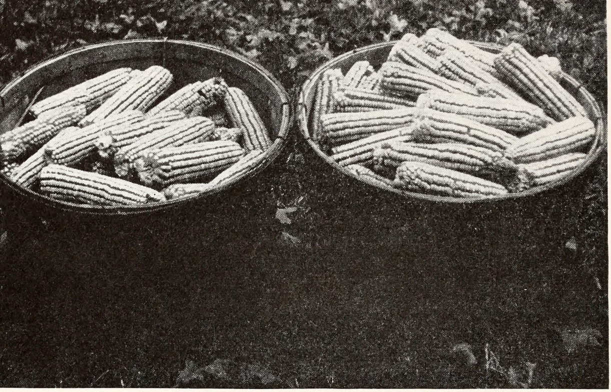

FIG. 4. THE ACTUAL EARS PRODUCED ON TEST PLOTS GROWN SIDE BY SIDE ON THE PIEDMONT BRANCH STATION ARE SHOWN. N. C. HYBRID 1032, A YELLOW HYBRID STRAIN, IS SHOWN IN THE RIGHT BASKET: YIELD 61.1 BUSHELS OF SHELLED CORN PER ACRE WITH 95 PERCENT OF PLANTS STANDING ERECT AT HARVEST. JARVIS GOLDEN PROLIFIC, USED AS CHECK VARIETY, IS SHOWN IN THE LEFT BASKET: YIELD 52.7 BUSHELS OF SHELLED CORN PER ACRE WITH ONLY 75 PERCENT OF PLANTS STANDING ERECT AT HARVEST.

istics were partially responsible for the extreme difference in yield. Unfortunately, these hybrid strains are more susceptible to weevil damage than are most local varieties and consequently could be best used either where early harvest or hogging off is anticipated.

### Locally Developed Hybrids Continue to Show Superiority[1]

Double-cross hybrids produced by crossing inbred lines developed from Southern varieties have shown marked superiority in adaptation as compared with corn belt hybrids. Several such hybrids have produced more grain than the local open pollinated varieties during the past two seasons. The best hybrid (N. C. Hybrid 1111, a white grained strain), grown on four branch stations located in four different regions of the state, averaged 49 bushels per acre as compared to 38 bushels per acre for the local varieties. This is an increase in grain yield of 29 per cent. The most promising yellow hybrid strain (N. C. Hybrid 1032) averaged 20 per cent more grain than the local varieties (see figure 4). This hybrid is highly resistant to wind or storm damage as shown by the percentage of lodged plants at harvest. N. C. Hyb. 1032 had 14.5 per cent of plants lodged as compared to 42.9 per cent for the local varieties. In other words, the local varieties had almost three times as many plants down because of storms as the hybrid strain. Two of the parent inbred lines used in making N. C. Hyb. 1032 are extremely strong rooted (see figure 5).

Inbred lines and single cross hybrids have been increased in the greenhouse during the fall of 1942. From this greenhouse grown seed several acres of seed producing corn can be grown in 1943, thereby making a fair quantity of hybrid seed available for farm trials in 1944.

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[1] Cooperation: Bureau of Plant Industry, U. S. Department of Agriculture.

## Sweet Corn Hybrids Suitable for Victory Gardens[1]

The commercial sweet corn hybrids are worth planting in home gardens. Because of their high sugar content, tender seed coat, and vitamin A value the yellow sweet corn strains are generally preferred for roasting ears by those familiar with them. Their susceptibility to ear worm damage has prevented them from being widely grown in the Southeastern states. However, if planted very early in the spring, even before the last frost, these hybrid strains usually escape serious earworm damage. By planting three different hybrid strains which differ in maturity the roasting ear period can be spread out over 10 to 14 days from one planting.

| Hybrid | Days from Planting To Roasting Ear Stage |
|---|---|
| Spancross | 70 to 72 |
| Marcross | 70 to 72 |
| Earligold | 70 to 72 |
| Lincoln | 75 to 78 |
| Golden Cross Bantam | 75 to 78 |
| Ioana | 78 to 80 |

The most promising sweet corn hybrids are earworm resistant strains involving parent lines received from the Texas Agricultural Experiment Station. The best of these had from 25 to 35 per cent of the ear tips clean and the remaining ear tips only slightly damaged by worms at roasting ear stage. Most susceptible strains had zero ear tips clean and considerable damage to many ears; in some cases the ear was completely damaged.

## Phosphoric Acid Not Always Needed for Corn In Eastern Carolina

Three years observations and records show that on Muck soil at the Blackland Experiment Station, Wenona, corn during its early stages of growth responds very markedly to fertilizers containing phosphoric acid. The plants are larger and greener for the first five or six weeks of development but as the plants develop toward maturity this difference disappears and there is practically no difference in yield of corn.

At the Upper Coastal Plain Station near Rocky Mount on a Norfolk sandy loam soil which has been fertilized regularly in past years with phosphate containing fertilizers no differences were observed in the early growth of the corn plants or in final yield whether phosphate was applied or not. Tissue tests indicated that the corn plants were high in phosphates throughout the growing season even on plots receiving no phosphate in the corn fertilizer.

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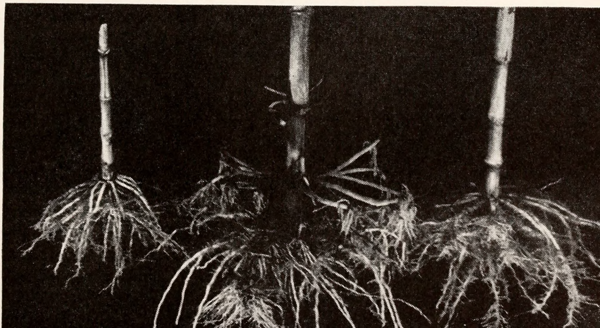
[1] Cooperation: Bureau of Plant Industry, U. S. Department of Agriculture.

FIG. 5. ROOT SYSTEMS OF THE TWO INBRED LINES (DEVELOPED FROM JARVIS GOLDEN PROLIFIC) AND SINGLE CROSS USED AS FEMALE STRAIN IN PRODUCING N. C. HYBRID 1032. INBRED LINE, J62, WITH SMALL ROOT SYSTEM IS SHOWN AT THE LEFT. IN THE MIDDLE IS THE SINGLE CROSS, J62 X J30; NOTE THE STRONG ROOT SYSTEM AND MANY BRACE ROOTS. TO THE RIGHT IS SHOWN THE INBRED LINE, J30, WHICH TRANSMITS ITS LARGE, STRONG ROOT SYSTEM TO THE SINGLE CROSS PROGENY.



# Cotton

## Hunger Signs In Cotton Plants

Cotton plants of the Coker 100 variety grown in sand culture in the greenhouse with various nutrient deficiencies exhibit symptoms characteristic of the deficiency.

Potassium deficiency was first shown by a dark yellowing in distinct areas between the veins in the older leaves. As the deficiency progressed the margins were more severely affected. The affected areas later turned brown and the leaves finally died and dropped off. The first stages of magnesium deficiency were shown by a light yellowing between veins in the older leaves, the yellowing being more general and in less distinct areas than in the case of potassium deficiency. In the severely affected leaves scalding occurred between the veins which left white areas.

Phosphorous deficiency was shown by dark bluish green leaves and slender stems. Nitrogen deficiency was characterized by a yellowing of the leaves, the deficiency appearing first in the older leaves. The older petioles showed a slight reddening. Calcium deficiency symptoms were indicated by an initial rolling downward and inward of the older leaves. Later the tissue in the lower stem and lower petioles broke down and became black. The leaves then wilted and fell off. Boron deficiency was shown first by a retardation of growth of the meristematic tissue and the younger leaves became crinkled and somewhat chlorotic. The flowers eventually died back. In general appearance the leaves appear rosetted at the top, and the plant had thickened stems and petioles and was somewhat stubby. The upper stems and petioles were ringed and extremely brittle.

## High Content of Soluble Salts In Fertilizers Harmful to Cotton[1]

Varying the sources of nitrogen and potassium to produce a high soluble salt content in the fertilizer decreased both stand and yield of cotton. To obtain a high soluble salt content due to nitrogen, sodium nitrate was used instead of organic nitrogen. To obtain a high soluble content due to potassium, manure salts were used instead of muriate of potash.

Two years results show that in a 6-8-4 fertilizer, tripling the soluble salt content from both nitrogen and potassium sources decreased stands 30% and yields 12%. The same salt content in a 9-12-6 fertilizer, applied at ⅔ the rate per acre of the 6-8-4 fertilizer, produced approximately a 15% reduction in stand and a 6% decrease in yield.

The harmful effect of a fertilizer high in soluble salts varies with moisture conditions and the texture of the soil, the detrimental effect being greatest at low moisture conditions and in very sandy soils.

## Placement of Fertilizer Bands Important In Obtaining Good Stands of Cotton[1]

A one-year test of five combination-fertilizer distributors and planters and one fertilizer distributor indicates that placement of the fertilizer bands too close to the row decreases stand. One machine placed the fertilizer in one band two inches to the side of the seed, one machine in two bands

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[1] Cooperation: Bureau of Plant Industry, U. S. Department of Agriculture.

1½ inches to each side of the seed, and the other four in two bands approximately 3½ inches to each side. With the machines placing the fertilizer 1½ and 2 inches away from the seed, the stand was approximately one-half that obtained when the fertilizer was distributed 3½ inches to the side.

### Cotton Following Peanuts Needs Additional Potash[1]

An average of the results of experiments conducted for five years at five locations in the Coastal Plain show that cotton grown in rotation with peanuts, where both the hay and the nuts are removed, is benefitted by additional amounts of potash. Six hundred pounds of a 6-8-4 fertilizer was compared with the same amount of a 6-8-8 fertilizer at four of the locations. At the fifth location, the Upper Coastal Plain Experiment Station, 6-8-6 and 6-8-12 fertilizers were used.

An over-all average of the results indicates that the high potash fertilizer increased the yield of seed cotton 130 pounds per acre. The response was particularly marked at the Upper Coastal Plain Experiment Station in 1942. The 6-8-12 fertilizer produced 525 pounds more seed cotton than the 6-8-6 fertilizer. At the above station the leaves of the cotton receiving the low potash began to turn yellow and drop off the first part of August, while the majority of the leaves on the cotton receiving high potash remained green and stayed on the plant until the middle of October.

Fertilization of the peanuts with two rates of potash had little effect on cotton yields. At one location when the soil was rather acid, the addition of dolomitic limestone to the peanuts had a favorable effect on cotton yields.

### Legume Cover Crops Help Supply Nitrogen for Cotton[1]

The results of the first year of an experiment located at the Upper Coastal Plain Experiment Station indicate that the legume cover crops, Austrian winter peas, hairy vetch, and crimson clover, as compared with no cover crops, increase the yield of cotton. The cotton after the cover crops received two treatments, an 0-8-8 fertilizer and a 3-8-8 fertilizer, while with no cover it received three treatments, a 0-8-8, a 3-8-8, and a 6-8-8 fertilizer. All fertilizers were applied at the rate of 600 pounds per acre.

In the cotton-corn rotation the cotton, after Austrian peas with the 0-8-8 fertilizer, yielded the same as the cotton after no cover and receiving the 6-8-8 fertilizer. After hairy vetch, with the 0-8-8 fertilizer, the cotton yielded more than the cotton after no cover with a 3-8-8 fertilizer. In the cotton-peanut rotation, cotton after each of the three legumes and fertilized with the 0-8-8 fertilizer, yielded higher than the cotton following no cover with the same fertilization. Hence, a good stand of legume winter cover crops will furnish a large part of the nitrogen necessary for cotton.

### Sidedressing Cotton Affects Composition and Yield of Lint and Seed[1]

Studies for one year indicate that sidedressing cotton affects the potash content of the lint and seed as well as the yield of seed cotton. Sidedressing with 150 pounds each of sodium nitrate and muriate of potash plus an initial application of 400 pounds of a 4-8-4 fertilizer has shown that the potash content of the lint and seed in the early period of boll development was twice as high with sidedressing as that with no sidedressing. This difference decreased as the boll matured. There was no difference in the content of nitrogen, phosphorus, calcium or magnesium between the two treatments. The effect on yield was marked in that sidedressing gave an increase of 325 pounds of seed cotton per acre.

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[1] Cooperation: Bureau of Plant Industry, U. S. Department of Agriculture.

[1] Cooperation: Bureau of Plant Industry, U. S. Department of Agriculture.

### Yield and Staple Length of Cotton Improved Through Research

Cotton yields in North Carolina have been gradually increasing during the past 70 years. Yields for the period of 1871-80 averaged 156.5 pounds, while the period of 1931-40 averaged 303.5 pounds. The only period showing a decrease was 1921-30, which can be largely attributed to the advent of the boll weevil. Research, which has made possible better farming practices, better fertilization, and more productive varieties, is largely responsible for the increased yields per acre.

The staple length has also been increased during recent years. In 1928 only 5.4 per cent was 1 inch or longer, while 60 per cent of the 1936 crop and 93 per cent of the 1941 crop was of these lengths. Cotton was somewhat shorter in 1942 due to adverse weather conditions during the growing season. The percentage of middling and better cotton was also less than in 1941 on account of frequent rains during harvesting and insufficient labor to keep up with picking. With the increased use of dryers and greater care in ginning, some gins actually had fewer gin damaged bales than in 1941. Production of long staple cotton was about doubled to help supply the greatly increased demand for defense purposes.

### Quality and Production Vary In Cotton Varieties[1]

Experiments indicate that some of the most productive strains and varieties have very good quality of fiber (length, uniformity, fineness and strength), while others have poor. Mexican strain No. 7-13-20 and Stoneville 4B-2-1 were among the more productive strains at the Upper Coastal Plain Station and had extra strong fiber as shown by fiber breaking tests and X-ray. Two lines selected from Coker 100 were slightly more productive but the fibers were not nearly as strong. Certain hybrid combinations are producing good yields and are showing consistently good fiber properties. All selections from another hybrid combination had weak fibers. A three-way cross (Mexican x Farm Relief) x Coker 100, appears to be the most outstanding hybrid at Statesville, N. C. The fiber strength of 10 varieties and strains grown at both Statesville and Rocky Mount averaged 18.9 per cent stronger at Rocky Mount than at Statesville. The strongest fiber is usually produced under stress conditions, and the weather was very hot and dry at Rocky Mount during July while rainfall was better distributed at Statesville. Coker Wilds (1¼ inch staple) produced approximately ⅔ as much lint as the best medium staple varieties at Statesville and ¾ as much at Rocky Mount.

### Inbreeding Helps Separate Good Cotton from the Bad

Results from work done at the North Carolina Station show that a single seed from a boll of cotton bears lint consisting of different kinds of fibers. For example, it was found that there were long, short, thin, thick, fine, coarse, strong, and weak fibers on the same seed. Fibers from the seed of some of the plants appeared to be fairly uniform as to length, strength, and fineness. Efforts are being made to develop from pure lines of cotton strains having uniform fibers on the seed and good yielding qualities. Uniformity of fiber characteristics, such as length, strength, and fineness, are desirable from the standpoint of better quality. Most of the inherited lack of uniformity of fibers in a sample of cotton is usually caused by differences on the cottonseed. Therefore, if strains having uniform fibers on the seed could be found, more uniform cotton could be produced for the markets.

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[1] Cooperation: Bureau of Plant Industry, U. S. Department of Agriculture.

Some of the inherited lack of uniformity of fibers in cottons is due to differences between plants. Inbreeding and selection have been carried on at the North Carolina Station with several commercial varieties for two to six generations or seasons. In 1942 it was found that these varieties were a mixture of strains, which differed in such fiber characteristics as length and fineness and also in yielding ability, plant type, storm resistance, boll size, and gin turn-out. Some of the pure inbred lines appear to be as vigorous or even more so than the variety from which they were selected, and several appear to be promising. For example, a pure strain from one variety has an undesirable staple length of ⅞ inch, while another pure strain from the same variety has a desirable staple length of 1 3-16 inch and seems to possess other good characteristics. The results to date point to the fact that inbreeding accompanied by selection should be carried on in commercial varieties in order to develop pure varieties of good cotton. Contrary to some opinions, the results show that inbreeding does not have any bad effects upon the variety, but merely separates the good from the bad cottons and enables the breeder to develop pure lines of good cotton.

### Cotton Strength Varies With Environment[1]

Fiber strength varies, depending upon the type of weather which occurs at the time the cotton boll is developing. It has been shown previously that fiber strength is influenced by stress conditions (deficiency of moisture) in the early period of wall thickening; i.e., approximately 16 to 30 days after flowering. The greater the stress conditions are at that time the stronger the fibers.

During the past year, work has been done to determine the amount of variation in fiber strength present within a single growing season at a single location. Flowers were tagged daily and collected at maturity. Fiber strength tests were made from bolls which flowered on successive days throughout the growing season. These tests were made with a Pressley strength tester. In a selfed line of cotton, significant differences were observed from material of two successive days' taggings, if the weather varied at the time the wall was being deposited. This work showed how the strength varied with the environment and agreed with previous results. Variations of 25 to 30 per cent in strength were observed in material developing less than 10 days apart.

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[1] Cooperation: Bureau of Plant Industry, U. S. Department of Agriculture.

Varietal differences were also studied. In general, the strength of fibers from two varieties will show the same reaction to environments, the strength of one being constantly higher than the strength of the second.

### Reginning Cotton Seed Increases Speed of Emergence and Number of Plants

In tests made in 1942, cotton seed that had been reginned to remove the linters before planting gave a somewhat larger number of plants at thinning time than seed having the normal amount of linters. Greater differences were observed in speed of emergence. As was also true in tests made in 1941, the reginned seed came up faster than the seed not reginned. The speed of emergence varied somewhat in different tests. In tests run at two locations the speed of emergence of reginned seed relative to seed not reginned was as follows:

| Treatment | Rocky Mt. | McCullers |
|---|---|---|
| Seed not reginned | 100 | 100 |
| Reginned moderately | 385 | 187 |
| Reginned heavily | 432 | 216 |

Cultivation can begin earlier in fields planted to reginned seed.

When cotton seed are dropped in hills that are spaced to make thinning between hills unnecessary, it is important to drop such a number of seed in each hill that there shall be an adequate number of plants surviving after the usual reductions by soil-inhabiting parasitic fungi. A test was made in fine sandy loam soil contaminated with Rhizoctonia to determine the approximate proper number of reginned, Ceresan-treated cotton seed to drop per hill. Seeds of a lot having good germination were dropped at rates of 4, 8, and 12 seeds per hill. At thinning time, 24.1% of the hills were missing where 4 seeds had been dropped, but only 4.9% and 4% were missing where 8- and 12-seed hills were planted. To avoid excessive skips in soils of this kind approximately 8 seeds should be dropped in each hill.

### Delinted Cotton Seed Should Not Be Planted Too Deep

Cotton seed is sometimes delinted with sulphuric acid before planting. This treatment removes the linters and destroys most of the spores of disease-producing organisms on the seed. Three tests were made on sandy loam soil to determine if acid-delinted seed should be planted at a depth different from that used for planting normal fuzzy seed. The two kinds of seed, each dusted with Ceresan, were planted at 3 depths: shallow, ⅝ inch; medium deep, 1⅛ inch; deep, 1⅞ inch. The three plantings encountered 3 distinctly different kinds of weather conditions and results varied with these conditions. For each type of seed, however, the medium deep planting gave the highest percentage of seedling emergence. These tests indicate that both acid-delinted and normal fuzzy seed, planted at a depth of 1⅛ inches in sandy loam soil will give more satisfactory seedling stands than planting ⅝ or 1⅞ inches deep. It is probable that the same recommendation will hold for reginned seed.

### Substitutes for Ceresan Seed Are Sought In Cotton Seed Treatment Tests

Treating cotton seed before planting to destroy spores of disease-producing organisms has become a general practice. Some form of Ceresan, either 2 or 5% concentration, is the dust commonly used. Owing to the threatened shortage of mercury, the active element in Ceresan, a number of non-mercurial substances have been tested. Of these non-mercurial substances which are likely to be obtainable for seed treatment purposes, Spergon and Spergonex seem to give greatest increases in number of plants. However, neither of these materials appear to give quite as satisfactory results on cotton as the Ceresan preparations. Both are at present somewhat more expensive to use than Ceresan.

The usual dosage for 5% Ceresan is 1½ oz. per bushel of cotton seed. In experiments made in 1942, application of ¼ and ½ ounce per bushel gave as large increase in number of plants per row as applications of 1 and 2 ounces. Weather conditions following planting in 1942 were not favorable to high seedling disease losses. However, in case of shortage of chemicals for seed treatment, the quantity available may be spread over a larger quantity of seed by reducing the dosage to ½ or ¾ ounce per bushel with the fair probability of as large increases as if the usual 1½ ounce dosage had been used. If Spergon or Spergonex is used the dosage should be 2 ounces per bushel of seed of material containing 50% active ingredient.

### Hormones Fail To Boost the Cotton Plant

A number of chemical substances, commonly referred to as hormones, have been shown to have profound effects on some phases of plant development. Certain hormones are widely used in the rooting of cuttings. The beneficial results from their use in that capacity suggested that these substances might prove useful as seed treatment materials. Preparations containing indolbutyric acid, naphthalene acetic acid, potassium naphthalene acetate, and Rootone (naphthol acid amide and thiourea) were used as dust treatments for cotton seed. Each chemical was used at two rates of application: (a) 1 part of chemical to 10,000 parts of seed, and (b) 1 part chemical to 40,000 parts of seed. Each chemical was used alone and also in combination with Ceresan. Certain of the preparations retarded seedling emergence at both concentrations used and reduced the stand of seedlings at the highest concentrations. None of the chemicals produced visible increases in growth or vigor of young plants nor significant increases in weight of seedlings. In one test on coarse sandy loam, slight increases in yield were recorded but these are of questionable significance. The same preparations did not produce increases in another planting on a fine sandy loam soil. The above mentioned chemicals added to soil in 4 concentrations in greenhouse tests failed to increase the size of cotton seedlings as determined by height measurements. Both the field and the greenhouse tests indicate that the amount of growth-promoting substances present in the cotton seed itself is adequate for the needs of the cotton seedling and that supplements of these materials are not needed by young cotton plants.

In addition to seed treatments with hormones, preparations containing naphthalene acetic acid and levulinic acid were dusted onto growing plants. In one series of tests applications were made in the early part of the blooming period, in another series applications began at the middle of the blooming period. In no case was the yield of seed cotton increased by dusting the blooming plants with preparations containing the above-mentioned chemicals.

### Flax and Hemp Studies In North Carolina[1]

During the summer of 1942, investigators were carried out on the growth and structure of hemp fibers. Studies of this type had been made previously by several investigators but this work was carried out using new technics which had been developed in connection with cotton studies.

In general, the work agreed with previous investigations upon flax and hemp development. However, there was some indication that even the most careful retting produced some deterioration of the cellulose to the fibers. It was quite obvious that flax and hemp cannot be grown profitably in this part of North Carolina.

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[1] Cooperation: Bureau of Plant Industry, U. S. Department of Agriculture.

## Pastures and Forage

### Low Hop Clover Increases Pasture Production In Lower Coastal Plain[1]

The possibility of using low hop clover in permanent pastures was perhaps the most promising single item in the pasture experiments being conducted at the Lower Coastal Plain Station during 1942.

Dallis grass, in single combinations with 8 different legumes, was studied under 6 fertilizer treatments. Yields were obtained by monthly clippings. By assuming that a milk cow in full production consumes 100 pounds of grazing material daily it is possible to calculate the value of pasture improvement in terms of carrying capacity. It would require four and one-half acres of unimproved Dallis grass pasture to provide grazing for the six months period from April 1 to October 1. The sod on this particular plot was as good as the average eastern North Carolina pasture. The addition of mineral fertilizers (that is, limestone, phosphate and potash) to this particular sod did not increase the yield because there were no legumes present. By applying 200 pounds of nitrate of soda annually a little over 3 acres would have been necessary to graze one cow for the six months period. This increase in yield would probably not have been economical.

The Dallis grass plus low hop clover sod, when treated with limestone, phosphate and potash, would have required only one and one-half acres per cow for the same period. The fertilizer, consisting of 800 pounds of superphosphate and 200 pounds of muriate of potash, was applied only in 1940. Applying nitrate of soda annually did not increase the productivity of the grass-low hop clover areas.

The yields in figure 6 indicate that the advantage of low hop clover as compared to Kobe lespedeza is during April, May and June, the time of the year when pastures are usually inadequate. This large early spring yield is due to the actual presence of the low hop clover, since it is a winter annual and dies during June. The ideal sod would be a combination of grass with lespedeza and low hop clover, but unfortunately the two legumes do not grow well together. It is hoped that future studies will demonstrate ways of making this possible.

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[1] Cooperation: Bureau of Plant Industry, U. S. Department of Agriculture.

### Minerals Necessary In Coastal Plain Pastures[1]

Five years of experimental results of the permanent pasture studies in the upper Coastal Plain have shown that Dallis and Bermuda grass are the two that are best adapted to well drained, sandy loam soils of this area. Lespedeza, white clover and low hop clover have been the most promising legumes.

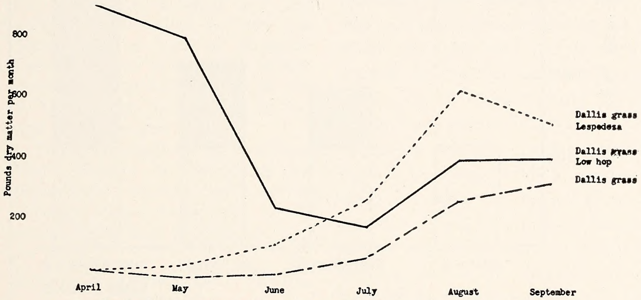

Fig. 6. Monthly yields of Dallis grass-Lespedeza, Dallis grass-Low hop clover, and Dallis grass alone. (Fertilized with limestone, superphosphate and muriate of potash).

Fertilization with phosphate and potash has greatly increased the yields of all sods that contained legumes. The clovers have succeeded only where lime was applied in addition to the above-mentioned fertilizers. Since the best pasture sods contain clover as well as lespedeza, it is recommended that limestone, phosphate and potash (where needed) be added to all pastures.

### Poor Soils Can Yield Good Pasture[1]

The type of response to limestone and phosphate that often occurs on badly depleted and eroded soils is typified in the results from a field in Buncombe County. These data are shown in graphic form in figure 7.

They illustrate three points that are of particular interest to farmers in the present war emergency: (1) Pasturage can be produced satisfactorily on poor land without commercial nitrogen; (2) both **limestone** and **phosphate** are essential, neither will do the job alone; (3) annual applications of limestone or phosphate are not essential. In this case the response to both materials was greater during the second season than the first.

### Proper Liming and Fertilization the Key to Good Pastures In Western North Carolina[2]

Limestone, phosphate and lespedeza have been very successful in increasing stands of bluegrass in western North Carolina pastures. In one case the bluegrass has in-

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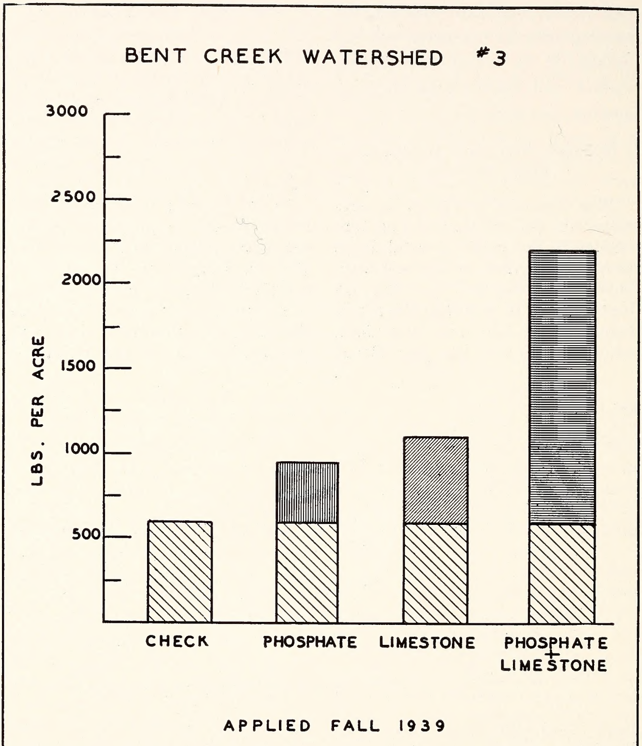
[1] Cooperation: Bureau of Plant Industry, U. S. Department of Agriculture.

[1] Cooperation: Appalachian Forest Experiment Station.

[2] Cooperation: Tennessee Valley Authority.



RESPONSE OF LESPEDEZA PASTURE TO PHOSPHATE AND LIMESTONE

FIG. 7

creased from 2 per cent in 1941 to 17 per cent in 1942 on the treated plots, but remained below one per cent on the untreated plots.

Both limestone and potash seemed to be necessary to the control of broomsedge on one pasture. Limestone and potash reduced the percentage of broomsedge in the sod by more than one-half, while neither limestone alone nor potash alone affected the broomsedge. This is the first instance of this kind in this area, and it is not known whether or not it represents a general condition.

In another instance phosphates increased the percentage of protein in the herbage when used with potash, but failed to do so without potash.

Limestone and phosphate continue to be the most important materials in increasing the yield and density of pasture sods. Potash increased yields in most cases but the increases were not very large.

The 2000 pound rate of limestone on a field in Haywood county is still maintaining yields as well as the 4000 pound rate at the end of five years. This indicates that the 2000 pound initial application was the proper one to apply and that another application is not yet needed. On a field in Cherokee County one ton of limestone is producing just as high yields as are 2, 3, or 4 ton applications at the end of the second season.

Phosphate applications have been very effective in increasing the phosphorus content of pasture herbage. This increase was 47 per cent on one field and 44 per cent on another.

### Grasses In Western North Carolina Pastures[1]

Plant population counts in June and September have indicated that the rate of seeding orchard grass is not a big factor in establishing stands of grass on relatively poor land in western North Carolina. The percentage of orchard grass in the total plant cover is as follows:

| Pounds orchard grass seeded | Percentage of orchard grass in total plant cover |
|---|---|
| 5 pounds + 15 pounds of other grass | 30 per cent |
| 20 pounds | 34 per cent |
| 3 pounds + 17 pounds of other grass | 21 per cent |

It is apparent that from 5 to 10 pounds of orchard grass would be as effective as heavier rates in obtaining stands.

Total yields as well as plant population counts have shown that Canada bluegrass, tall meadow oatgrass, and timothy are not adapted as permanent pasture grasses in western North Carolina. Orchard grass has established itself much more quickly than either Kentucky bluegrass or redtop. It has required three years under the more favorable treatments for Kentucky bluegrass to establish itself. Redtop has occupied an intermediate position between the other two grasses with respect to rapidity of establishment. Actual measurements have shown that redtop is much more tolerant to adverse growing conditions than either orchard or Kentucky bluegrass; it is not as responsive to soil treatments. These studies have indicated the advisability of seeding the three grasses together for permanent pastures in the mountain section.

Limestone, phosphate and potash increased yields very satisfactorily on these seeding experiments. The increase was from 1700 pounds on the check to 3600 pounds on the treated plots. The addition of nitrogen to these treatments caused the growth to be heavier early in the season and lighter as the season progressed, with little effect upon the total season's growth.

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[1] Cooperation: Tennessee Valley Authority and Bureau of Plant Industry, U. S. Department of Agriculture.

### Many Types of Kentucky Bluegrass Are Found In North Carolina[1]

Striking differences in the growth habit, leafiness, and vegetative vigor of Kentucky bluegrass strains were observed in the grass breeding nursery at Raleigh during 1942. About 200 different strains, originally collected from naturalized bluegrass colonies occurring in the lower Piedmont and Coastal Plain, were compared with each other and with various commercial types. Within each strain the plants were relatively uniform, but the differences between strains were marked. The bluegrasses of North Carolina origin were frequently equal or superior in vigor to the commercial types, but the latter were more uniform. No quantitative data were taken as the new seeding had not become firmly established.

Nearly 150 additional Kentucky bluegrass samples were collected from the upper Piedmont and Mountain sections and added to the nursery. A second nursery, including all the local and commercial types was also established at the McCullers Station. The breeding material now under observation includes representative strains from 95 North Carolina counties, and promises to be an excellent source from which improved varieties may be selected for use in North Carolina pastures.

### Why Does Dallis Grass Breed True?[1]

The mystery which heretofore has obscured the pasture research worker's understanding of seed formation in Dallis grass is gradually unfolding under the lenses of a compound microscope. Preliminary study has shown that the cells which produce the all-important pollen grains do not function normally and consequently much of the pollen produced is not normal. Since normal pollen must be present in abundance to assure a full set of seed, these facts help to explain the low seed production of Dallis grass. Still a mystery, however, is the fact that the seeds from any one plant always produce offspring which appear as much alike as human identical twins. There isn't much chance of selecting new pasture varieties under these conditions. Further microscopical studies are in progress to aid the grass breeder in overcoming this obstacle.

### Korean and Kobe Lespedeza Give Best Yields[1]

Preliminary studies during the summer of 1942 have indicated that Kobe and Korean yield approximately the same under the same grazing conditions. If planted together, the total yield was approximately the same as either alone, but Kobe contributed only one-third of the combined yields. Common and Tennessee 76 made much less growth. The yield of a mixture of Kobe with either common or Tennessee 76 was intermediate between the two. Where Korean and common were seeded together the picture was decidedly different. The combined yield was equal to the yield from a pure stand of Korean, but was made up of 90 per cent Korean and 10 per cent common. These results would raise some question as to the advisability of seeding common or Tennessee 76 with either Korean or Kobe.

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[1] Cooperation: Bureau of Plant Industry, U. S. Department of Agriculture.

[1] Cooperation: Bureau of Plant Industry, U. S. Department of Agriculture.

### Hard-Seeded Strains of Crimson Clover Being Developed[1]

Strains of crimson clover have been discovered which produce a considerable portion of hard seed. This seed does not start to grow until late August even though buried in the soil throughout the summer. Three strains out of 8 tested the past season gave satisfactory volunteer stands. These strains still contain considerable soft seed and attempts will be made to obtain selections with uniform hard seed.

### Phosphate and Lime Increase Yield of Sericea Lespedeza[1]

On a Cecil loam soil at the Piedmont Branch Station over a 2-year period the yield of sericea lespedeza has averaged 1.56 tons hay per acre without treatment, 2.04 tons with 50 lbs. superphosphate per year, 1.90 tons with 2 tons lime applied previous to seeding, and 2.33 tons when treated with both lime and superphosphate.

### Phosphate and Lime Increase Yields of Oats and Lespedeza[1]

During the season of 1942 in an oats-lespedeza rotation, phosphate and lime increased the yields of oats and Korean and Kobe lespedeza at the Piedmont Branch Station. Without fertilizer the yield of oats was 23.8 bushels per acre, 32.8 bushels with a treatment of superphosphate containing 40 pounds of phosphoric acid, and 33.5 bushels where the land had received 2 tons lime in 1940 in addition to the superphosphate. Lespedeza yielded 1.29 tons hay without fertilizer, 1.95 tons with the superphosphate and 2.30 tons with lime and superphosphate. Kobe and Korean lespedeza gave similar responses to the fertilizer treatments.

### Tift Sudan Grass Superior[1]

Tift Sudan, a variety developed by the U. S. Department of Agriculture in cooperation with the Georgia Agricultural Experiment Station, was tested in North Carolina for the first time in 1942. Yield trials at the McCullers Station indicated the improved variety to yield approximately 30 per cent more hay than commercial Sudan grass. When cut more frequently to simulate grazing conditions, the yield was approximately the same for the two varieties.

The greatest advantage of the improved variety was its complete resistance to rust. This disease is always prevalent in the state, but is much worse in areas having grown Sudan in previous years. At the McCullers Station, the Tift variety was still green November 1, whereas the commercial was severely infected by August 1.

In experiments at the Piedmont Branch Station, Tift Sudan furnished 23 per cent more grazing and hay than the common strains on market. Common Sudan became badly infected with leaf spot diseases. Tift Sudan has shown only a trace of disease during the 2 years it has been tested. The first cutting of hay of Tift is of much better quality than that of the common. Any aftermath of common Sudan is of very poor quality and low in yield. The aftermath of Tift is green until frost and yields as well as the first growth.

At the Central Dairy Farm, 30 cows were fed on an average of 400 pounds per day from July 20 to September 15 from two acres of Sudan grass planted early in June. In addition, eight tons were ensiled with satisfactory results. The two acres were equally divided, one-half planted in Common, the other in the Tift strain. The rate of growth and yield were approximately the same, but the Tift strain showed a marked advantage in rust resistance.

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[1] Cooperation: Bureau of Plant Industry, U. S. Department of Agriculture.

[1] Cooperation: Bureau of Plant Industry, U. S. Department of Agriculture.

### Borax Increases Yield and Seed Production of Alfalfa[1]

Borax applied to nine alfalfa fields in the Piedmont area of the state during the winter of 1940-41 continued to control yellows caused by boron deficiency and to increase the hay and seed yields during 1942.

During 1941 yield increases of ¾ ton of air-dry hay were noted on some of the 13 fields then under test. In 1942 some of the same fields showed increases in hay yield of 1,600 pounds due to the borax application made two years previously.

The average increase per acre in hay yield in the cuttings made in 1941 on 13 farms was over 500 pounds per acre for each of the three rates of borax used. In 1942 the average increases on 9 fields in the cuttings made where the borax was applied two years previously are as follows: 8.8 lbs. borax gave an increase of 514 lbs. air-dry hay; 17.6 lbs. borax gave 638 lbs. air-dry hay; and 26.4 lbs. borax gave 602 lbs. air-dry hay. For the two-year period each dollar invested in borax has returned on an average a net return of $14.00. The average cost for the borax application is $1.00 per acre.

In 1942, as well as in 1941, it was noted that the borax-treated plots withstood the invasion of crab grass better during the latter part of the growing season. They are also maintaining their stands better with an increase in plant vigor generally.

During the season of 1942 at the Piedmont Branch Station, the third crop of alfalfa on untreated soil was severely damaged by boron deficiency. Soils previously treated with 25 pounds borax per acre showed no damage. In a strain test at the Station, which included 10 new hybrids and 5 standard varieties, symptoms of boron deficiency were marked during late July. Damage varied from 25 percent in Grimm to 49 percent in Turkestan. Kansas Common, the most common strain in North Carolina was intermediate in reaction.

The growth of alfalfa seed stocks in North Carolina is now possible provided the boron requirements of the plant are met. Results indicate that not only increases in hay yield may be expected by the use of borax, but that seed yields can be considerably increased as well. Plots receiving no borax yielded from 9 to 30 pounds of seed per acre, while plots receiving borax yielded from 110 to 173 pounds of seed per acre. It is possible to allow one of the cuttings to mature seed for harvest, preferably the second cutting, and also obtain two cuttings of hay. At the present market price of seed the seed harvested from an acre would be valued at $45.00 to $70.00.

Twenty-five to 35 pounds of borax to the acre (no more) should be mixed into the fertilizer prior to seeding alfalfa. In established stands where borax has not already been applied, the application can be made by mixing the borax with the spring top-dressing fertilizer material. Granulated agricultural borax may be broadcast alone with the cyclone-type seeder if it is properly adjusted.

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[1] Cooperation: Bureau of Plant Industry, U. S. Department of Agriculture.

# Peanuts and Soybeans

## "Pop" Formation In Peanuts Being Solved

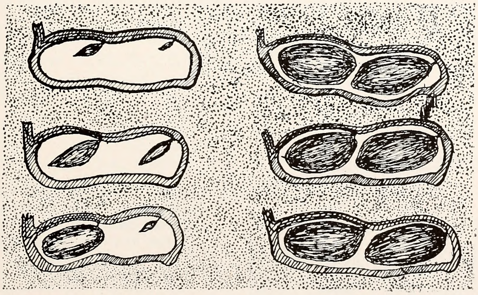
Large types of peanut varieties frequently produce undeveloped kernels or "pops" which are illustrated by the drawings in figure 8. The shell forms normally but one or more kernels fail to develop properly.

Unfavorable balance of mineral nutrients in the soil is one of the common causes of the formation of "pops."

To study the cause of "pop" formation, the fruiting medium was isolated from the rooting medium as shown in figure 9. Peanuts were planted in rooting media supplied with varying proportions of calcium and potash. In one case calcium in the form of gypsum was added to the pure quartz sand of the fruiting medium and in another potash was added, and in a third, both calcium and potash were added. Calcium was found to be necessary in the fruiting medium for good production of well filled nuts irrespective of the nature of the rooting medium. Potassium in the fruiting medium had a very unfavorable effect. Nuts of intermediate quality developed in the fruiting medium to which both potash and calcium had been added. In another experiment a soil which was known to produce "pops" in the field was used as the fruiting medium and this soil produced good fruit only when calcium was supplied. The effects of calcium and potash added to the soil rooting medium and to the quartz sand fruiting medium are shown in Table 1. The results are expressed as per cent of well filled nuts in relation to the total number produced by each treatment.

The absorption and translocation of minerals from the fruiting medium by growing peanut fruits were shown by putting lithium, an element not normally found in plants, in the fruiting medium.

FIG. 8. DIAGRAMATIC VIEW SHOWING THE NATURE OF INFERIOR FRUIT OR SO-CALLED "POPS" WHICH ARE FORMED UNDER UNFAVORABLE NUTRIENT CONDITIONS. THE "POPS" ARE SHOWN ON THE LEFT AND ON THE RIGHT ARE SHOWN WELL FILLED FRUIT.



This element was later found in all parts of the plants.

### Correct Placement of Potash and Calcium Important For Good Peanut Yields

A field experiment in Bladen County showed the importance of proper placement of potash and calcium in obtaining good stands and high yields of well filled kernels. When either muriate of potash or a more insoluble salt, potassium metaphosphate, was placed underneath the seed (in the rooting zone) the stand was significantly decreased. When muriate of potash was applied on top of the row (in the pegging zone) on June 15, yields were decreased and a large number of undeveloped kernels or so-called "pops" resulted.

Calcium in the form of gypsum gave a significant increase in yield when it was applied in the row and an even higher yield when applied on top of the foliage. When both gypsum and muriate of potash were applied, much better yields were obtained when the potash was put underneath the seed (in the root zone) and the gypsum applied on top (in the pegging zone) than when the placement was reversed. These results illustrate the importance of meeting the calcium requirement for the developing nuts and of placing the potash properly. The best procedure is to apply the potash as the peanuts come through the ground. In this way stand injury is prevented. By recommendation, the ridge left by planting is leveled by a drag so the top dressed potash is at the ground level. This makes it possible by cultivation to cover it deep enough to prevent any decrease in yield due to the potash in the pegging zone.

### Apply Potash to Cotton for Following Peanut Crop[1]

The direct application of potash in quantities which make up for the loss of this element by crop removal (approximately 175-200 pounds muriate of potash) is not practical since applications of even smaller amounts of muriate of potash (75 to 100 pounds) have caused decreases in stand and yield. Results from rotation experiments at five locations show that the application of 100 pounds muriate of potash added to cotton preceding the peanuts gave as high peanut yields as did the application of 50 pounds to each crop. Furthermore,

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[1] Cooperation: Bureau of Plant Industry, U. S. Department of Agriculture.

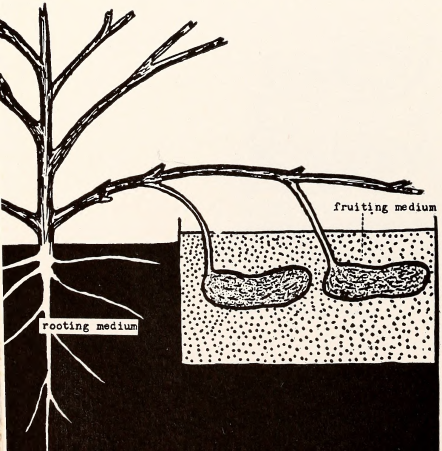


FIG. 9. DIAGRAMATIC VIEW SHOWING THE METHOD EMPLOYED IN ISOLATING THE FRUITING MEDIUM FROM THE ROOTING MEDIUM.

TABLE 1. Per Cent of Well Filled Nuts as Affected by Calcium and Potash

| *Rooting Medium* | *Fruiting Medium* | | |
|---|---|---|---|
| | *Calcium* | *Potash* | *Calcium and Potash* |
| Low Ca<br>High K | 82 | 0 | 30 |
| High Ca<br>Med. K | 98 | 8 | 76 |

the yield of cotton is higher when it receives the entire quantity of muriate of potash.

These results show that fertilizing the peanuts through the cotton crop is a practical procedure. They illustrate the importance of adjusting the fertility program to take into consideration the fertility requirements of all crops in the rotation.

### Virginia Bunch Peanuts Produce Well with Wide Spacing

Width-of-row studies conducted at the Upper Coastal Plain Station during the 3-year period, 1940 to 1942 and "skip tests" carried on in 1940 and 1942 show Virginia type peanuts capable of utilizing more space than is commonly supposed. In the width-of-row studies three strains of this type produced the following average yields in pounds per acre: 30-inch spacing gave 1459 lbs.; 36 inches gave 1439 lbs.; 42 inches gave 1419 lbs.; and 48 inches gave 1303. There was no serious drop in yield until the width of row exceeded 42 inches. The optimum width will, however, vary with the fertility level of the soil and also with the rainfall. In the dry season of 1941, yields were as good at 48 inches as in the narrower widths.

In the "skip tests" sufficient seed was planted to secure perfect stands, with hills 8 inches apart. Part of the hills were removed to simulate stands broken in different ways. For instance, in certain plots one hill was removed and five left, in others three hills were removed and five left, while in still others five were removed and five left. These reductions in stand amounted to approximately 16⅔, 37½ and 50%, while the corresponding reductions in yields were only 2.5, 11.5 and 15.5%.

While perfect stands are necessary for maximum yields, peanuts of the Virginia type are able to partially utilize breaks in stand up to 24 inches or more. Since this is true, growers should go slow in plowing up a crop with the idea of planting over as late planting will probably result in a greater loss of yield than poor stands. In date-of-planting tests conducted during the past three years the reduction in yield due to delaying planting from May 10 to June 10 was approximately 34%, which is more than twice as great as the reduction obtained in the skip test with a 50% stand.

These data are not applicable to White Spanish peanuts. Improved White Spanish was included in the width-of-row studies and showed a reduction in yield for rows wider than 36 inches as compared with a maximum of 42 inches for Virginia types. Rows 24-30 inches apart are recommended for the small White Spanish with hills 4 inches in the row.

### Large-Seeded Peanut Types Lead In Yields

Large-seeded peanuts outyielded the smaller seeded types in the 1942 variety studies at three locations, namely Perquimans, Edgecombe and Bladen counties. In the Old Belt the average yields obtained were as follows: Virginia Bunch, 1377; Jumbo Runner, 1303; Knight's or Martin County Runner (Intermediate in size between Jumbo and N. C. Runner), 1461; North Carolina Runner, 1162; and Improved White Spanish (2B), 1021. (For relative size of varieties see Fig. 10). Of the large-seeded varieties, which have been grown in the past largely for the edible trade, the Virginia Bunch has led in tests conducted in Edgecombe, Halifax, Northampton and Bertie counties, while the Jumbo Runner produced heavier yields in Perquimans County. The differences obtained have been found to be due, partly at least, to differences in the shedding of pods, a larger percentage of the runner type shedding than the bunch. This difference is not so noticeable on soils that are in good physical condition at harvest time as on soils that tend to be cloddy.

On a basis of 500 pounds of oil per ton for the Virginia Bunch types and 600 pounds for the Improved White Spanish, which are fair estimates for the quality of nuts produced in these tests, the yields of oil per acre were as follows: Martin County Runner, 365; Virginia Bunch, 339; Jumbo Runner, 326; Improved White Spanish, 306; and N. C .Runner, 291.

In the Bladen County tests the results were more favorable to the Improved White Spanish. As an average for the three tests conducted in this county this variety produced 1261 pounds per acre as compared with 1418 pounds for the Virginia Bunch. On a basis of the analysis used above the yield of oil amounted to 378 pounds for the Spanish and 355 for the Virginia Bunch.

### New Peanut Selection Shows Promise for Oil

Because of the increased demand for peanuts for oil, a number of small-seeded varieties with high shelling percentages were included in all three advanced tests in 1942. The yield and shelling percentages of four of these are given in Table 1.

Of special interest are the relatively high yields secured with Georgia Sel. 207-2. This strain led all others in a "New Variety Test" conducted at the Upper Coastal Plain Station in 1941 and in the Advanced Variety Test at the same location in 1942. It is a bunch type of medium early maturity and makes a very vigorous growth. It offers real promise in the production of oil.

### Station Workers Develop New Breeding Techniques for Peanuts

The propagation of peanuts by means of cuttings was tried in greenhouse and field experiments as a method of increasing the number of plants from a limited number of seed, as would be true with hybrid seed. It was found that practically 100 per cent of cuttings treated with Rootone developed roots and grew as normal plants. The yields of plants grown in the field from cuttings were equal to

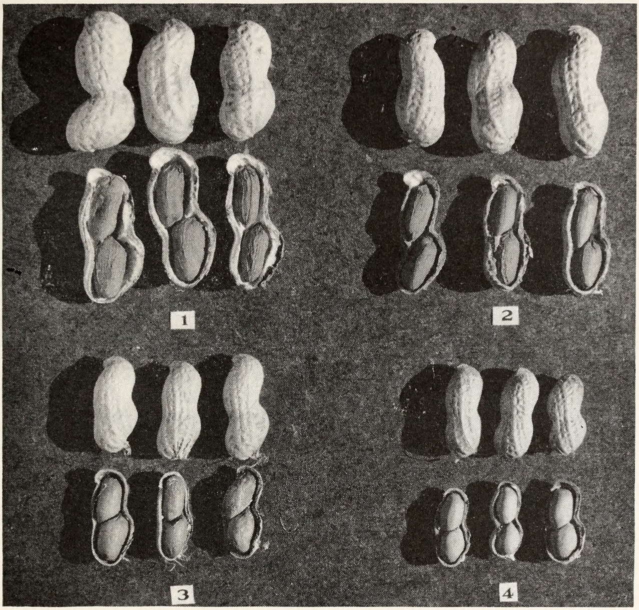


FIG. 10. RELATIVE SIZE OF FOUR TYPES OF PEANUTS USED IN A NUMBER OF EXPERIMENT STATION TESTS: (1), JUMBO RUNNER; (2), VIRGINIA BUNCH; (3), MARTIN COUNTY RUNNER; AND (4), IMPROVED WHITE SPANISH (2B). THE LARGER SEEDED TYPES PRODUCE HEAVIER YIELDS IN AREAS WHERE ADAPTED. THE SMALLER TYPES, HOWEVER, USUALLY PRODUCE PLUMPER SEED, A HIGHER SHELLING PERCENTAGE, AND A CORRESPONDINGLY HIGHER OIL CONTENT.

the yields of plants grown directly from seed in the same test and no differences in yield were obtained between plants from main stem cuttings and lateral stem cuttings. See Fig. 11).

### Copper-Sulfur Dust Continue To Give Best Control of Peanut Leafspots

Peanut leafspots were unusually severe in 1942 on all varieties. This was evidently related to frequent rains and periods of relatively low temperature, both of which are favorable for development of the leafspot fungi. Comparisons were again made of the leafspot control values of dusts containing 3, 6, and 9% metallic copper, with and without sulfur as a diluent. These tests were made on the Virginia Bunch Variety. The copper-sulfur mixtures consistently gave better leafspot control than did the coppers or sulfur alone when measured in terms of percentage defoliation. The 3% copper-sulfur mixtures gave signficantly less leafspot control than did those mixtures con-

TABLE 1. YIELD IN POUNDS PER ACRE AND SHELLING PERCENTAGE OF FOUR SMALL SEEDED VARIETIES OF PEANUTS IN 1942 TESTS

| *Variety* | *Yield in pounds per acre* | | | *Shelling %* |
|---|---|---|---|---|
| | *Edgecombe* | *Perquimans* | *Bladen* | *Bladen only* |
| Small runner* | 1594 | 876 | 893 | 67.8 |
| White Spanish | 1708 | 1021 | 1005 | 74.9 |
| Imp. White Spanish | 2067 | 917 | 1425 | 69.3 |
| Ga. 207-2 | 2572 | 1076 | 1557 | 74.5 |

* Average of N. C. Runner and similar strains from Georgia and Alabama.

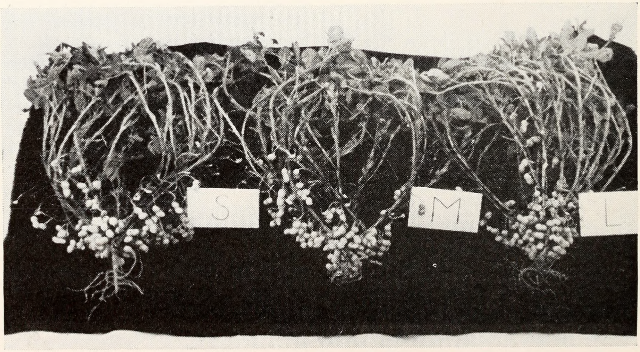
taining 6% copper. The mixtures containing 9% copper gave leaf spot control about equal to 6% copper; however, they depressed yields. A close correlation was obtained between leafspot control and increased yields. One of the best copper-sulfur mixtures, which contained 6% copper derived from cuprous oxide, gave a yield of 2124 pounds of peanuts per acre, whereas plots that received no treatment yielded only 1124 pounds per acre, the increase from dusting amounting to an even 1000 pounds per acre. (See Figure 12).

Under the favorable weather conditions for leafspot development in 1942 four dust applications gave greater increases in yield than did three. In contrast, under the drought conditions of 1941 three applications proved equal to four.

### Tests Evaluate Leading Varieties of Soybeans

The standard varieties Tokio, Wood's Yellow, and Herman continue to rank high among strains available to North Carolina farmers. Tokio is widely adapted to varying soil and climatic con-

FIG. 11. PEANUT PLANTS GROWN FROM SEED (LEFT) AND FROM CUTTINGS. CUTTINGS MADE IN THE GREENHOUSE FROM MAIN (M) AND LATERAL (L) STEMS OF MOTHER PLANTS AND SET IN THE FIELD AT TIME OF PLANTING SEED.



ditions. Wood's Yellow is much more sensitive to these conditions, but is excellent where adapted. Herman is still the highest oil bean available, though it shatters severely.

*Ogden,* a new bean from Tennessee, has been very promising in all Coastal Plain tests. It is a low growing, much branched, very prolific, green seeded type with some shatter resistance. *Arksoy* is a fair yielding variety that is very shatter resistant and is well liked by combine operators because of its small stem.

Laredo is commonly considered as a root knot resistant variety. However, Palmetto and a few other new strains demonstrated much better resistance than Laredo where there was a heavy infestation of nematodes. (See Figure 14).

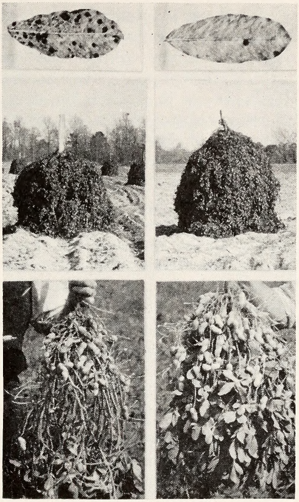


FIG. 12. PEANUT LEAFSPOT CONTROL. LEAF, STACK, AND PLANT FROM AN UNDUSTED PLOT (LEFT) AND A DUSTED PLOT (RIGHT).

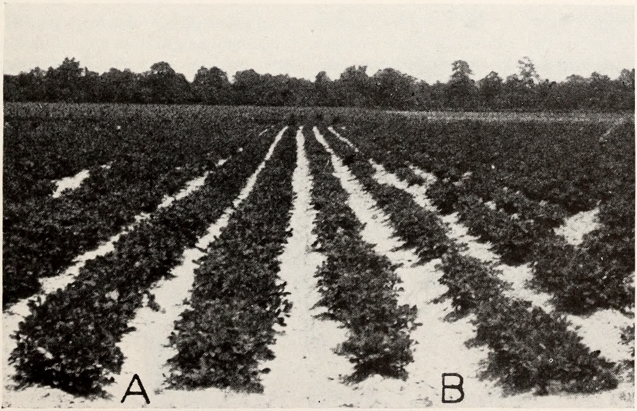


FIG. 13. STANDS OF PEANUTS FROM TREATED SEED (A) AND UNTREATED SEED (B) ON AN EASTERN NORTH CAROLINA FARM IN 1942.

### Soybeans Do Well Following Small Grain and Strawberries

Soybeans planted after a spring crop will do very well under favorable conditions. Since the time which the plants have to make beans is cut to a minimum, enough fertilizer must be present to support rapid growth. In Columbus County soybeans following oats produced only 14 bushels per acre, while following strawberries they produced 27 bushels, indicating the effect of the residual fertilizer.

On the strawberry land there was little difference between varieties, but on the poor oat land Tokio and Herman yielded 14 bushels as compared to 9 for Wood's Yellow.

### Mosaic Disease of Cowpea Reduces Yield

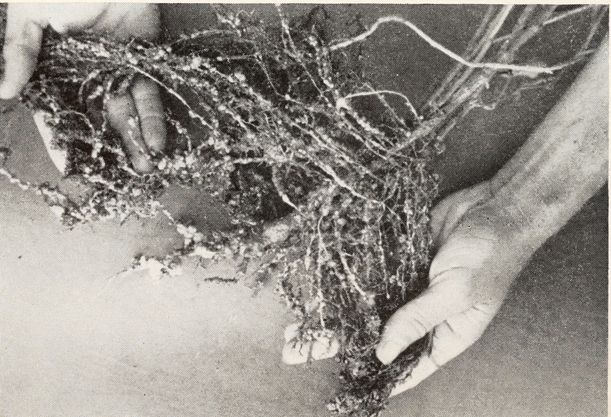
A virus disease known as mosaic is present in many fields of cowpeas each year. Observations indicate that this disease causes considerable stunting of affected plants, but that varieties differ considerably in the degree of stunting attributable to the disease. In a field experiment in which diseased and healthy plants were grown under the same soil and weather conditions, it was found that the dry weight of tops of diseased plants was 52% less than that of healthy plants for the Whippoorwill variety but only 5.7% less for the Brabham variety. Weight of ripe pods and seeds produced on diseased plants was 25% less for Whippoorwill variety and 12% less for the Brabham variety than from healthy plants. The Brabham variety as shown by this test as well as by observation of greenhouse grown plants is significantly more tolerant or resistant to mosaic than is Whippoorwill.

A yellow spot disease is found on an occasional plant in cowpea fields. Bright yellow spots, few to many in number, appear on the leaves. These spots fade to light yellow and eventually become almost white. This is caused by a virus which is readily transmissible by rubbing juice of diseased plants on to healthy plants. Limited tests indicate that the virus is not transmitted through seed.

### Seed Treatment Means Insuring Peanut Stands

Results of peanut seed treatment experiments conducted in 1942, confirmed those obtained in 1941, and emphasized the importance of this practice as a means of secur-

FIG. 14. SOYBEAN PLANT SEVERELY INFESTED WITH NEMATODES.



ing adequate stands of this crop under adverse conditions (see fig. 13). Approximately 25 different chemical dusts have been tested for their efficiency in protecting peanut seed against decay-producing organisms and thereby improve stands. These materials have been tested under both greenhouse and field conditions on both hand-shelled and machine-shelled seed of the Virginia Bunch and Spanish varieties. Four materials have consistently given outstanding increases in emergence, and are being recommended as peanut seed treatments for 1943. Recommended materials, rates of application, and approximate costs for treating 100 pounds of shelled seed of any variety are as follows:

Arasan (50% tetramethyl thiuram disulfide)—2 to 3 ounces—.16c to .24c.

2% Ceresan (2% ethyl mercury chloride)—3 to 4 ounces—.12c to .16c.

Yellow Cuprocide (Cuprous oxide)—4 ounces—.12c.

Spergon (tetra chloro-parabenzoquinone)—4 ounces—.50c.

These materials can be applied to the seed with either the barrel type of treater or with power-driven machines with automatic dust feeds.

Comparisons of hand-shelled and machine-shelled seed treated and untreated yielded some striking results in 1942 as shown in the following table:

| Variety | Percentage emergence of peanuts that received the stated treatments | | | | | |
|---|---|---|---|---|---|---|
| | Hand Shelled | | Machine Shelled | | Unshelled | |
| | Untreated | Treated with Arasan | Untreated | Treated with Arasan | Untreated | Treated with Arasan |
| Va. Bunch | 69.0 | 76.2 | 39.1 | 60.7 | .... | .... |
| Spanish | 68.5 | 82.6 | 57.5 | 71.7 | 32.5 | 39.2 |

It will be noted that machine shelling reduced germination considerably; however, this was largely, but not entirely, overcome by seed treatment. Hand shelling is quite laborious and expensive, especially on the Spanish Variety. These data indicate that machine shelling combined with seed treatment offers a good alternative for obtaining adequate stands and, at the same time, for substantially reducing the cost of preparing the seed for planting. Under most conditions adequate stands cannot be expected from planting unshelled Spanish seed unless a very heavy rate of seeding combined with seed treatment is practiced.

# Small Grains

### Official Variety Tests Initiated

The initiation of a state wide testing program, known as "The Official Variety Tests," in the fall of 1941 is expected to determine more accurately the range in adaptation of both old standard varieties and new varieties which should be developed from time to time. During the first year of this program tests were conducted at 6 locations in the state on some 10 to 12 strains each of wheat, oats and barley. The results from these tests were released in the fall of 1942, and will be released annually in the future.

### Progress Made In Barley Breeding

Sunrise, a mildew resistant variety first released from the Piedmont Station in the fall of 1940, showed up well in all tests conducted in 1941-42, with the exception of the lower Coastal Plain test where the yield of all varieties was relatively low. As an average for the past 5 years at the Piedmont Station the following yields (bushels per acre) have been obtained on certain varieties: Sunrise, 59.3; Davidson, 53.0; Randolph, 49.8; Iredell, 47.4; and Tennessee No. 6, 38.7. In these tests certain smooth-awn strains obtained from the Division of Cereal Crops and Diseases, Bureau of Plant Industry, U. S. Department of Agriculture, have produced heavier straw yields than either of the above-named varieties and one, Smooth Awn 88, produced grain yields approximately equal to that of Davidson. In three of the five Official Variety Tests conducted this year this strain led all varieties tested in yield of grain. These new types offer promise as forage barleys. They are mildew resistant (see figure 15) but, like Sunrise, are quite susceptible to the floral-infecting loose smut.

Breeding work is underway in which an attempt is being made to combine the smut resistance of varieties such as Iredell and Davidson and the mildew resistance of Sunrise. Slightly in excess of 1000 fourth-generation selections were planted at the McCullers Station in the fall of 1942 for study as to their disease reaction.

A new observation barley nursery was seeded in this state for the first time in the fall of 1942, in cooperation with the Division of Cereal Crops and Diseases. This nursery contains the Division's entire collection of winter barleys (over 700). They were classified in the summer of 1942 at Madison, Wisconsin, for reaction to both mildew and leaf rust. This collection undoubtedly contains much new material which will be of value in the Station's breeding program.

### New Oat Varieties Standing Up Well

In oat smut inoculation tests conducted by the Division of Cereal Crops and Diseases, in cooperation with 14 widely scattered experiment stations in 1942, Letoria and Lelina, smut and rust resistant varieties being distributed by the N. C. Agricultural Experiment Station, showed an average of 0.1 and 0.8 per cent smut infection, respectively, as compared with 13.4 per cent for Fulghum, an old standard variety. No smut was found in these two new varieties in the tests in Maryland, North Carolina, and Georgia. For all practical purposes the resistance they exhibited is satisfactory.

Letoria is also one of the most winter hardy varieties developed to date from the cross Lee x Victoria (from which cross several varieties are now in general use in the South), but it is not so hardy as varieties such as Fulwin and Hairy Culberson. Letoria has been crossed with Fulwin for the purpose of combining still greater winter hardiness with factors for smut and rust resistance. Slightly over 600 head selections from this cross were planted in the fall of 1942 for study as to their disease reaction. These selections are from plants surviving the winter of 1941-42 at the Swannanoa Station, during which winter approximately 63 per cent of the plants in the nursery were killed by freezing.

Another lot of promising material in the 1941-42 nursery was composed of stiff-strawed selections from a cross of Lee x Bond, which would stand well for harvesting with combines. They are more susceptible to smut than are Lelina and Letoria. One of these stiff-strawed strains was outcrossed to both of these varieties in the spring of 1942 in order that more nearly smut immune strains of this type may be developed.

### New Rust Resistant Wheats Show Promise

In four tests conducted in the Piedmont and Mountain areas in 1941-42, three new rust resistant wheats averaged 35.7 bushels per acre as against 32.0 for Leap, 35.3 for Nittany and 36.6 for Carala. These new wheats, which are from a cross of Malakoff x Nittany, have shown good rust resistance in this area. They are being tested for milling and baking quality at the Federal Soft Wheat Laboratory, Wooster, Ohio. If the quality tests are satisfactory, one of them may be distributed in small quantities in 1944.

Material which should offer even greater possibilities for the development of high yielding, rust resistant wheats was received from the Division of Cereal Crops and Diseases and grown in an observation nursery at McCullers in 1941-42. This group of selections are from crosses between soft winter wheat varieties, including Purple Straw and Redhart, and Frondosa, Fronteira, and other rust resistant types. The better of these were placed in a special yield test in the fall of 1942.

### Early Seeding Gives Higher Yields

The yields of oats, barley, and wheat from an experiment conducted at the Piedmont Branch Station, Statesville, are strong evidence that North Carolina farmers should seed their small grains earlier than is now commonly practiced. Seedings made November 15th produced only 80 per cent as much grain as seedings made November 1st or before.

One year's results with different amounts of seed per acre indicate that the rates now recommended are near optimum.

### Stands of Wheat Reduced By Cottonseed Meal

Cottonseed meal as the only source of nitrogen in a fertilizer equivalent to a 4-12-6 caused as much as a 28 per cent reduction in stand of wheat below that obtained when sulfate of ammonia was used as the nitrogen source. The fertilizer was applied at the rate of 300 pounds per acre in the drill rows. Along with the reduction in stand, there was a corresponding very early retardation in growth of the individual plants.

The injury to or reduction in stand is closely associated with the character of the soil. The reduction was most severe on the sandy loam soils which are relatively low in organic matter; on the fine textured soils relatively high in organic matter the reduction in number of plants was not apparent.

### Legumes In Rotation Reduce Need for Mineral Nitrogen for Small Grain

In experiments at the Piedmont Branch Station, small grain grown on land which was already at a high fertility level did not give sufficient response to top dressing with nitrogen to justify the practice. This serves to re-emphasize the fact that the growing and turning under of legumes such as lespedeza, red clover, and alfalfa can take the place of much of the nitrogen otherwise supplied in fertilizer form.

### Barley Better Than Oats and Wheat for Lespedeza

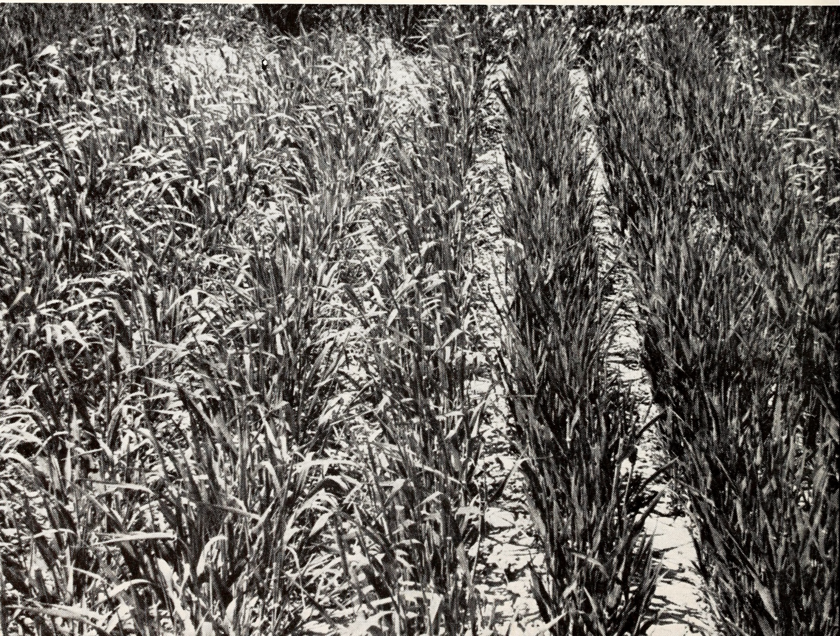
Yields of lespedeza hay are affected by the kind of small grain grown preceding. An experiment conducted at the Piedmont Branch Station, Statesville, show the following differences:

| Crop Preceding Lespedeza Hay | Average Yield Lespedeza Hay per Acre |
|---|---|
| Oats | 3185 lbs. |
| Wheat | 3629 lbs. |
| Barley | 4524 lbs. |

These differences in yield may be attributed to differences in earliness and growth habits of the respective small grains. The largest yield of lespedeza hay was produced following barley which is early maturing and on which the leaves are

(Continued on Page 45)

FIG. 15. IREDELL BARLEY (LEFT) SUSCEPTIBLE AND SUNRISE RESISTANT TO MILDEW. THESE VARIETIES HAVE BEEN HYBRIDIZED TO COMBINE THE SMUT RESISTANCE OF IREDELL AND THE MILDEW RESISTANCE OF SUNRISE.



# Tobacco

## Good Root Growth Makes More and Better Tobacco[1]

Experiments at the McCullers Branch Station show very clearly that tobacco yields and value per acre in 1942 were directly related to the root growth of the plant. The amount of fine roots was closely related to the total root weight. The preceding crop was important in making the soil better for the growth of tobacco roots. The better root systems and higher acre values were obtained with tobacco following legumes. (See table 2 and figure 16). It should be emphasized that the tobacco following legumes was fertilized with less nitrogen and more phosphate and potash.

## Heavy Applications of Nitrogen Reduce Granville Wilt of Tobacco[1]

Applications of uramon, sulfate of ammonia, and calcium cyanamid at the rate of 200 pounds of nitrogen per acre were made preceding rye on fields heavily infested with Granville wilt at Hester and Apex in 1940-41 for the purpose of controlling the disease. A very vigorous growth of rye was produced.

The field at Hester was seeded to corn in the spring of 1941 and grown to maturity. The check plots yielded an average of 16.7 bushels, whereas the nitrogen treated plots yielded an average of 37.3 bushels per acre. The 1941 summer crop at Apex was a mixture of soybeans and sudan grass. The first cutting which was made by the middle of July yielded 2,150 pounds of hay for the check plats and 5,360 pounds per acre for the nitrogen-treated plats.

In 1942 both fields were planted with tobacco. The percentages of wilted plants at Hester on August 1 by treatments were as follows: check 83%; calcium cyanamid 40%; sulfate of ammonia 40%; uramon 29%. The total amount of wilt at Apex on July 30 was as follows: check plats 78%; calcium cyanamid 33%; sulfate of ammonia 28%; uramon 26%.

## Controlling Granville Wilt of Tobacco[1]

Tobacco grown after one year of bare fallow was completely destroyed by Granville wilt but tobacco grown after one year of corn or soybeans produced about fifty per cent of a normal crop.

In tests to determine minimum rate and the most effective date of application of urea on soil for wilt control, it was shown that 1,000 pounds per acre of uramon (42% N) applied in March reduced Granville wilt to 3.3 per cent. Rates of 250 and 500 pounds per acres were less effective. Tobacco grown on soil treated in October had slightly more wilt than tobacco grown on soil treated in March. In another experiment, 1,000 pounds per acre of uramon applied in March con-

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[1] Cooperation: Bureau of Plant Industry, U. S. Department of Agriculture.

[1] Cooperation: Bureau of Plant Industry, U. S. Department of Agriculture.

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(Continued from Page 44)

less dense on the lower portion of the plants. The lowest yield of lespedeza hay was produced following oats which is the latest maturing and also produces a very dense growth of leaves on the lower portion of the plants, thus shading the young lespedeza plants.

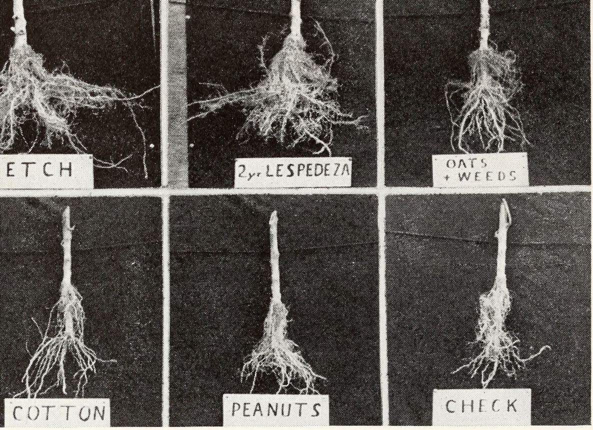

FIG. 16. ROOT GROWTH OF TOBACCO FOLLOWING DIFFERENT CROPS.

trolled wilt on black nightshade *(Solanun nigrum)*, Irish potato, egg plant, tomato, pepper, petunia and castor beans (Fig. 17).

Certain new strains, such as strains T.I. 448 A and 79 X, continue to show a high degree of resistance to wilt. In F4 hybrids of 448 A crossed on flue-cured varieties, resistance equalled that of the resistant parent. Quality of the more promising selections was much improved over that of 448 A but back-crossing and further selection must be carried out before the quality equals that of the better flue-cured varieties.

### Grow Tobacco In Rotation To Help Control Rootknot[1]

Two, three and four year rotations of various crops preceding tobacco continue to show a marked increase in money value over continuous tobacco culture. However, certain rotations cause very little reduction in nematode infestation. It is doubtful whether any rotation will eliminate root knot. Of the legume crops used in rotation, peanuts, crotalaria (spectabilis) and velvet beans greatly reduce the amount of infestation. Also common vetch, which is generally known to be quite susceptible, has satisfactorily controlled root knot on tobacco when grown continuously during the winter for several years.

Rye as a winter cover crop gives no appreciable reduction in the amount of root knot on tobacco but this practice continues to give a decided increase in yield and value over no winter cover crop.

Damage caused by the root knot nematode was more severe in 1942 than in 1941. This was especially true in localities where favorable growing conditions early in the season were followed by extremely unfavorable conditions later. In these localities, above ground parts of the plant showed marked symptoms. Often this does not occur in spite of heavy gall formation on the roots.

### Root Knot-Resistant Tobacco Seems Possible[1]

Results of 1942 experiments at the McCullers Branch Station further demonstrate the possibility of developing suitable root knot resistant tobaccos. Certain $F_3$ lines of the first back-cross of T. I. number 706 on flue-cured tobacco were equally as resistant as the original parent. A comparison of one of the better resistant hybrids is shown in figure 18.

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[1] Cooperation: Bureau of Plant Industry, U. S. Department of Agriculture.

[1] Cooperation: Bureau of Plant Industry, U. S. Department of Agriculture.

### Blackshank Resistant Strain of Tobacco Released[1]

A variety resistant to blackshank (Phytophthora), a disease which was first found near Walkertown, in Forsyth County, in 1930, is being released by the Oxford Branch Station for the 1943 plantings in areas where this disease has occurred in the Old Belt. Since blackshank occurs in the Eastern Belt in fields where both Granville wilt and root knot also are present, there is not much reason to encourage the planting of a variety that is resistant to only one of the diseases. Consequently, only a few plantings will be made in the east this year.

### Killing Weeds and Disease In Plant Beds[1]

A combination treatment for weed and disease control is highly desirable for tobacco seed beds. Chemicals that are satisfactory for weed control may not be effective against diseases. For example,

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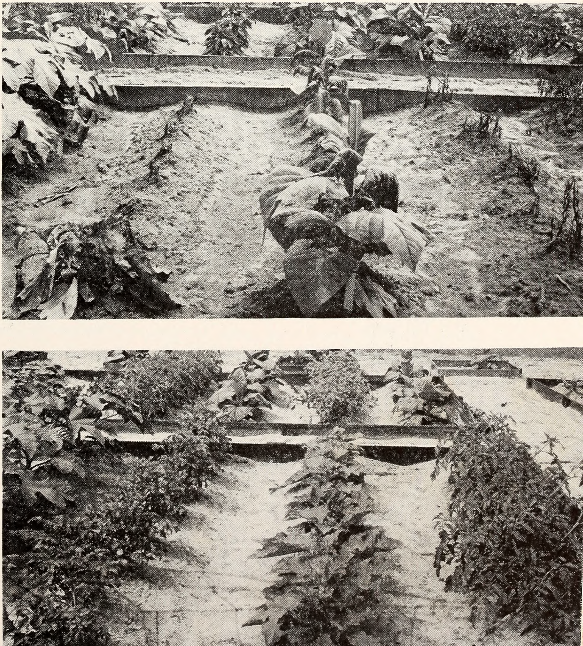
[1] Cooperation: Bureau of Plant Industry, U. S. Department of Agriculture.

[1] Cooperation: Bureau of Plant Industry, U. S. Department of Agriculture.

FIG. 17. CONTROL OF GRANVILLE WILT ON TOBACCO AND OTHER HOST PLANTS BY APPLICATION OF UREA TO THE SOIL. "A", UNTREATED PLOT SHOWING, LEFT TO RIGHT, BADLY WILTED ROWS OF EGG PLANT, TOBACCO, AND TOMATO. "B", AN ADJACENT PLOT ON WHICH URAMON WAS APPLIED IN MARCH, 1942, SHOWING HEALTHY ROWS OF IRISH POTATO, EGG PLANT, TOMATO, TOBACCO, AND OTHER HOST PLANTS.



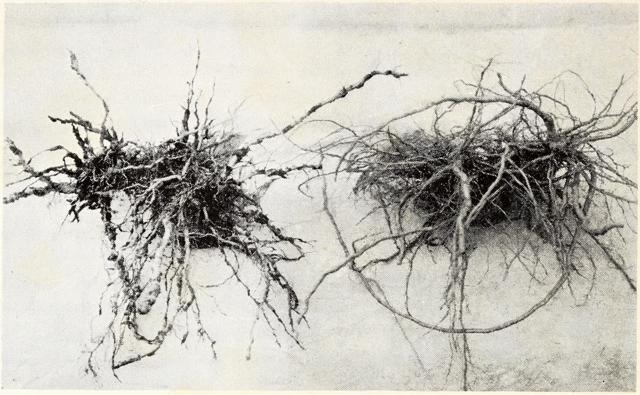


FIG. 18. RESISTANCE TO ROOT KNOT: LETT, SUSCEPTIBLE GOLD DOLLAR VARIETY. RIGHT, RESISTANT HYBRID (N 120 A).

cyanamid is effective against weeds but is of little value in controlling root knot. The soil type very definitely is a factor in the use of certain chemicals. At the McCullers Branch Station where the soil is sandy, urea applied at one pound per square yard is effective for weed and root knot control and is not toxic to the tobacco seedlings but on a heavier type soil at the Oxford Branch Station, toxic effects may seriously injure the seedlings. At the McCullers Station some of the better treatments from the standpoint of weed and root knot control were (1) a combination of cyanamid and chloropicrin, (2) cyanamid and ammonium thiocyanate combined (see Fig. 19), and (3) urea.

### Use of Hygrometer Improves Tobacco Cures[1]

Humidity control in tobacco barns has in the past been a matter of guess. The "feel" of the atmosphere is not a good indicator when simple wet and dry bulb theremometers are so easily installed in a barn. When wet and dry bulb thermometers are employed, the dry bulb indicates the correct firing of the furnace, and the wet bulb the correct manipulation of the ventilators.

During the initial yellowing period the wet bulb should read about 93° to 95° while the dry bulb is increased from 95° to 110°. After about forty hours the temperature is raised so the wet bulb reads about 102° while the dry bulb increases from 120° to 170°. If the wet bulb reads too low, the ventilators should be closed—if too high, the ventilators opened.

### Notes On Tobacco Insects[1]

Studies at the Oxford Branch Station on flea beetles have demonstrated that tightly constructed plant beds will protect the seedling plants from much of the damage

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[1] Cooperation: Bureau of Plant Industry, U. S. Department of Agriculture.

[1] Cooperation: Bureau of Entomology, U. S. Department of Agriculture.

TABLE 2.—Tobacco Data from McCullers Branch Station on Norfolk Sandy Loam Soil

| Preceding Crop | Average Weight of roots per plant | Yield Tobacco per acre | Value of Tobacco per 100 lbs. | Value of Tobacco per acre |
|---|---|---|---|---|
| | grams | pounds | dollars | dollars |
| Vetch[1] | 118 | 1732 | 41.19 | 713 |
| Lespedeza[1] | 70 | 1523 | 42.24 | 643 |
| Redtop[2] | 54 | 1287 | 44.11 | 568 |
| Oats (weeds)[2] | 37 | 1187 | 43.97 | 522 |
| Cotton[2] | 39 | 1141 | 43.66 | 498 |
| Check (tobacco)[2] | 41 | 890 | 43.68 | 389 |
| Peanuts[1] | 31 | 947 | 40.74 | 386 |

[1] 1000 lb 2-10-12 prior to planting.

[2] 1000 lb. 3-8-6 prior to planting. Topdressed with 100 lb. sulfate of potash and 50 lb. nitrate of soda.

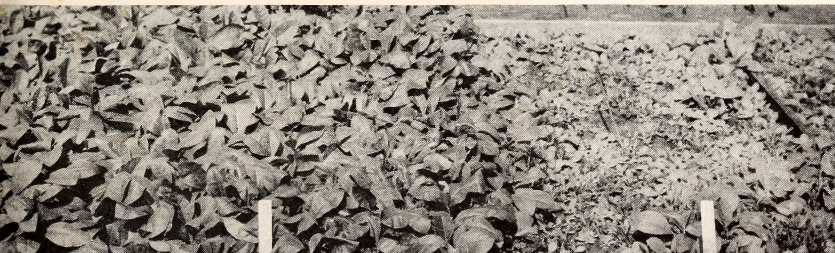
caused by these insects. If the plant beds are destroyed after transplanting to the field, it will remove a prolific breeding place from which the flea beetles move to the fields.

The protection of newly set tobacco plants by means of single applications of insecticides, either in the plant bed just before pulling or in the field immediately after setting, has been given attention and shows promise as an economical means of protecting small plants from flea beetle damage during a critical stage.

Comparative toxicity tests with new organic materials have shown that o-phthalonitrile and 2-fluorylamine are quite toxic to hornworms. Fall plowing and cutting of tobacco stalks after priming will prevent the build up of infestations of hornworms.

Tobacco moth studies have demonstrated that proper screening of buildings where tobacco is being continuously stored together with proper packhouse sanitation involving the prompt disposal of scrap, early cleaning of packhouses and discontinuance of the practice of storing grains and milled feeds in packhouses, will offer satisfactory protection from damage in areas such as Farmville, N. C. Satisfactory methods of controlling green June beetle larvae in plant beds are being developed.

FIG. 19. WEED AND ROOT KNOT CONTROL ON SEED BED SOILS BY THE APPLICATION OF CHEMICALS TO THE SOIL. LEFT, CYANAMID 1 LB. PER SQUARE YARD PLUS AMMONIUM THIOCYANATE ½ LB. PER SQUARE YARD IN SOLUTION. RIGHT, UNTREATED PLOT.



# HORTICULTURAL CROPS

## Apples and Peaches

### New Apple Rootstocks Come from England

Apple seedlings from crosses made in 1940 have been grafted on dwarf, semi-dwarf and vigorous root stocks. The original stocks came from the East Malling Experiment Station, Kent, England, and were obtained through the cooperation of the New York Experiment Station, at Geneva. Malling IX is a dwarf stock; Malling V semi-dwarf and Malling XVI a vigorous stock.

Twenty seedlings have been grafted on the three stocks. The advantage of the dwarf stock is that trees will come into bearing the second or third year after transplanting, thus making it possible to appraise the results of breeding work much sooner than would be the case on standard root stocks.

In addition to the seedlings, a number of standard varieties have been grafted on the three stocks for comparative studies. While dwarf and semi-dwarf trees are not considered important for commercial orchards, there is a growing demand for them from the home orchardist and the estate owner.

### Bordeaux Mixture Substitutes Offer Promise In Preventing Spray Injury on Apples

Studies on the effectiveness of various spray materials and schedules of application in the control of apple diseases were continued in 1942 at two orchards in the Brushy Mountains in the vicinity of North Wilkesboro. The varieties appearing in these tests were Red Delicious, Stayman, and Blacktwig. Detailed season records were kept of (1) weather conditions. (2) host development, (3) disease development, and (4) spray injury.

Weather conditions were more favorable for the development of apple diseases in 1942 than they were in 1941; however, none of the diseases reached epidemic proportions in 1942, excepting black rot (frogeye) on the foliage and bitter rot on the fruit late in the season. The following results were obtained in the control of these two diseases with copper sprays: (1) Applications of reduced concentrations of Bordeaux mixture (1-3-50) were not as effective in control of bitter rot and black rot as were applications of the usual strength (4-4-50); however, considerably less Bordeaux injury resulted from the reduced strength. Basic-copper sulfate and copper oxychloride were tested as substitutes for the standard Bordeaux mixture. While these materials did not equal Bordeaux in disease control, they did practically eliminate copper injury to the host and will receive further attention in this connection.

### Sodium Cyanide Best for Controlling Woolly Apple Aphid

Good control of the root form of the woolly apple aphid was obtained on experimental plats where sodium cyanide was dissolved in alkaline water and used at the rate of ½ gram per pint of water. At this rate of dilution, 2 grams were used in 4 pints of water per tree without injuring the tree. All the aphids were controlled on the trees treated with the above concentration. If the amount of sodium cyanide is increased to 1 gram per pint of water some injury may develop in the trees.

Concentrations of dichlorethyl ether that will control the aphids gave some injury to some of the trees.

Carbon disulphide and ethylene dichloride emulsion were used but the control was unsatisfactory.

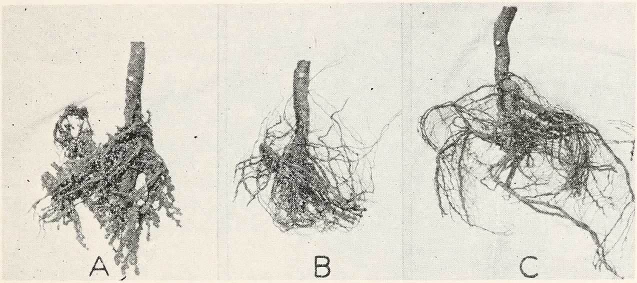


FIG. 20. CONDITION OF ROOTS OF PEACH TREES AFTER ONE-SEASON'S GROWTH ON NEMATODE-INFESTED LAND TREATED AS FOLLOWS: A, NO TREATMENT; B, TREATED WITH UREA; C, TREATED WITH CHLOROPICRIN.

### Chemicals and Resistant Root Stock Control Peach Root Diseases

Root knot *(Heterodera marioni)* and crown gall *(Bacterium tumefaciens)* on the peach may possibly be controlled by the use of certain chemicals of nitrogenous composition, according to experiments conducted during the 1942 season in the Sandhills. A "die back" condition of the lateral roots, which was found to be prevalent at the location where peaches had been grown for some 20 years, was somewhat reduced in its severity by the soil treatments. There is substantial evidence to indicate that the cause of this die back is either a bacterium or fungus pathogen rather than a deficiency or toxic condition resulting from continued peach culture.

Of the chemicals employed, Urea (see fig. 20) and Ammonium bicarbonate showed promise in a high degree of control as compared to the other chemicals used. Ammonium bicarbonate induced a 100% reduction in the root knot index over the non-treated with a mean percentage index of 50.7.

Crown gall was very heavy on the Shalil root stock while very little crown gall was found in the other treated plots. Chloropicrin gave excellent control of root knot and no "die back" could be observed (see fig. 20).

In testing the cumulative effects of the chemicals by setting trees in the plots that were treated and planted in 1941, it was found that quite a variation existed between the two locations under study. In general, the root knot index of 1942 was higher than that of 1941. Urea and sodium nitrate readily lose their cumulative effects as compared to chloropicrin and cyanamide.

Several of the chemicals were highly toxic while others produced stunting and poor vigor. Part of this is believed to be caused by late applications and insufficient rains to leach them before setting the trees. Shalil root stock exhibited practical immunity to the root knot nematode.

### Excellent Control of Peach Tree Borer with Ethylene Dichloride Emulsion

Treating 250 acres of Elberta peach trees in the Sandhills area with ethylene dichloride emulsion resulted in the number of borers in the peach trees being reduced the following year from an average of 10 to 12 borers per tree where paradichlorobenzene had been used to an average of 2 to 3 borers where ethylene dichloride had been used the year before.

Since it will probably be impossible to obtain ethylene dichloride for the duration of the war, it will be necessary to treat with paradichlorobenzene. It is very essential that paradichlorobenzene be applied to the trees between October 1 and October 25.

### Control Found for White Peach Scale

Field experiments during 1941-42 indicate that the white peach scale can be controlled with 2 sprayings with a 4% oil emulsion. The second spray of oil should come about 2 weeks after the first. Thorough coverage at each spraying is absolutely essential.

Single applications of oil (up to 16% actual oil), lime-sulphur or oil and lime-sulphur did not give satisfactory control of the white peach scale.

The two sprayings with a 4% oil emulsion gave as good control as scrubbing the tree and then spraying, and better control than just scrubbing the tree.

## Small Fruits

### New Types of Raspberries[1]

The large-fruited black raspberry of the Andes Mountains in South America, **Rubus glaucus**, has been successfully fruited and hybridized with American species. This is the first time crosses with Rubus glaucus have been accomplished in the United States. This species of interest to small fruit breeders because the fruit is very large but is small seeded, and the plant is very vigorous. Another peculiarity of the fruit is that, although it is a raspberry, it separates from the stem like a dewberry with the receptacle remaining inside the fruit. Such a fruit is less subject to damage from crushing after being picked.

Fruit from raspberry x dewberry hybrids are difficult to harvest because no abscission layer is formed and they will neither pick like a dewberry nor slip off the receptacle like a raspberry. Hybrids with **R. glaucus** may be the beginning of a new strain of raspberry x dewberry hybrids that will pick readily. True hybrids with Young dewberry, St. Regis red raspberry, and Cumberland black raspberry are growing in the field and will be watched with great interest.

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[1] Cooperation: Bureau of Plant Industry, U. S. Department of Agriculture.

Two other species that fruited this year for the first time, probably for the first time in the United States, are **Rubus tephroides** and **Rubus lambertanus** from Eastern Asia. These plants have been given various cultural treatments for several years but this was the first season that they have bloomed and borne fruit. Both of these species are peculiar in that they bloom in August and September at Raleigh, North Carolina, and the fruit ripens in early October. Hybrids of these may produce a race of vigorous productive fall fruited raspberries.

### Blueberries Earlier and Larger When Cross-Pollinated[1]

In a comparison of cross versus self-pollination of the Scammell, Weymouth, and Dixi blueberries, the fruit from the cross-pollinated flowers was earlier and larger and the percentage set was greater than from self-pollinated flowers. The berries from cross-pollinated flowers ripened a week earlier on Scammell, four days earlier on Weymouth, and eight days earlier on Dixi. The increase in size of the crossed over selfed berries was 21.4 per cent for Scammell, 13.5 per cent for Weymouth, and 8.8 per cent for Dixi. Since North Carolina growers are interested in early-maturing large-sized fruit, the present practice of providing for mixed variety plantings not only aids in obtaining a better fruit set, but also helps to provide earlier ripening and a better grade of berries.

### Yield of Blueberries Reduced By High Rates of Fertilizer Application

Yields of Scammell blueberry plants were greatly reduced during 1942 by high rates of fertilizer application, especially for mixtures containing a large amount of sulfur. In a comparison of rates of 500, 750, and 1000 pounds per acre of a high sulfur mixture, the yields were 538 16-pint crates per acre for the 500-pound rate, 415 crates for the 750-pound rate, and 301 crates for the 1000-pound rate. The size of berry was also much smaller on plants fertilized at the highest rate of application. The fruit graded 147 berries per cup at the 1000-pound rate compared with 123 berries per cup for the 500-pound rate. An extended period of dry weather occurred after the first fertilizer application, so the reduction in yield and grade of fruit was no doubt partly due to the lack of moisture during this critical period of growth.

### Red Spider Mite Controlled On Strawberries

Further research with "dinitro" dusts for control of the red spider mites on strawberries has shown that the diluted dusts can be used without causing severe injury to the foliage. Previous experiments had shown that dusts impregnated with dinitrol-o-cresol (1%) and dinitro-o-cyclohexylphenol (a commercial dust, DN-D4) would give control of the mites when diluted with 7 parts of pyrophyllite or sulphur.

While the undiluted dusts sometimes caused severe burning when applied at an unusually heavy rate, it was found that with a normal coverage, or with diluted dusts, the burning usually did not affect more than 5% of the leaves or more than 1½% of the total leaf surface. Burning was greater during hot weather and dusts applied near noon on a hot day caused

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[1] Cooperation: Bureau of Plant Industry, U. S. Department of Agriculture.

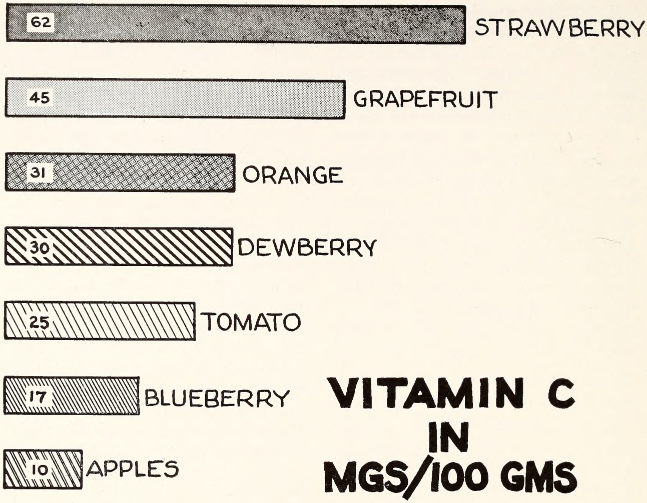

FIG. 21. STRAWBERRIES HAVE A HIGH CONCENTRATION OF VITAMIN C AS COMPARED WITH OTHER FRUITS.

greater injury than the same dusts applied several hours later. Red spider outbreaks usually come early when high temperature would not be a factor. During hot weather sulphur dust alone is effective in controlling the mites.

Mites have sometimes been destructive during the blossoming period and it has been observed that the petals are easily burned by dinitro dust. The question has been raised as to whether it affects the setting of the fruit. By tagging individual blossoms, it was found that undiluted dust applied directly on the blossoms caused most of them to dry up. When the undiluted dust was applied to the row in the normal manner, most of the blossoms were partly protected by leaves and set fruit. With diluted dust, even when directed into the blossoms, the proportion of blossoms forming berries was almost as high as with undusted plants. There was no evidence of injury to flower buds or small berries.

An attempt to prevent spring outbreaks of mites by late summer or fall applications of sulphur and dinitro dusts, was unsuccessful. Plots dusted in August and October did not show any marked difference from undusted plots when the mite population was estimated in the spring. The mites were well distributed over all plots and all plots would have been about equally infested if conditions for a rapid increase of mites had been present.

### Strawberries Rich In Vitamin C[1]

Strawberries have a high concentration of Vitamin C as compared with other fruits (fig. 21). Sun-ripened strawberries have a greater Vitamin C content than those ripened in the shade. The outer portion of the ripe strawberry contain more Vitamin C than the inner portion. There is a marked increase in Vitamin C content of strawberries during ripening. Strawberries show considerable varietal differences as to Vitamin C content which range from 79 to 32 milligrams per 100 grams of fruit. The varieties ranked in the following descending order: Fairmore, Missionary, Massey, and Blakemore.

Blueberries contained 16-18 milligrams of Vitamin C and not much difference was found between varieties. The Vitamin C content of the raspberry varieties analyzed were similar to the values obtained for dewberries and ranged from 20 to 33 milligrams per 100 gram of fruit.

Recent experiments have been conducted with reference to the stability of Vitamin C in small fruit. Cold storage temperatures resulted in very little decrease in Vitamin C content of fruit stored for three days. The Vitamin C contents of strawberries, blueberries, dewberries and raspberries are relatively stable as long as the skins remain in good condition. Blueberries retain their Vitamin C content longer than strawberries and the relative stability appears to be associated with the impervious nature of the skin. Mechanical injury by removing the calyx, bruising, puncturing and juicing results in rapid decomposition of Vitamin C in strawberries.

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[1] Cooperation: Bureau of Plant Industry, U. S. Department of Agriculture.

# Truck Crops

### Yield and Scab of Irish Potatoes Affected By Fertilizer Composition

One-year experiments at three locations in the Tidewater area indicate that scab, as well as yield, is affected by fertilizer composition. When a marked increase in yield was obtained as a result of the application of higher amounts of potash a marked reduction in scab was found. At one location, a low potash fertilizer containing gypsum as a source of calcium gave a significant increase in yield and a significant decrease in scab as compared with the same fertilizer containing dolomitic limestone as a source of calcium.

Increasing amounts of nitrogen (from 3 to 7%), of phosphoric acid (from 0 to 7%), and of potash (from 2 to 9%) in fertilizer applied at the rate of 2300 pounds per acre gave increased yields. A larger potash application (14%) gave lower yields than did either the 5 or the 9% levels.

Follow-up studies on the effect of nutrient balance on yield and scab of Irish potatoes are in progress. In order to more nearly attain the desired nutrient status in the soil, field experiments of longer duration are being initiated.

### Sulfur Soil Treatment Reduces Scab of Irish Potatoes

The soil-inhabiting organism

that causes scab of Irish potatoes is present in the soils on many farms of eastern North Carolina, and the losses from scab in the 1942 crop were considerable. In an attempt to control this disease a fall (1941) and early spring (1942) application of commercial flour sulfur was made to the scabby soils on two eastern North Carolina farms. The sulfur treatments on both farms significantly reduced the amount of scab that developed on the tubers of the 1942 crop. The full benefit of the sulfur treatment was probably not manifest in the first crop of potatoes following the treatment as all of the sulfur had not changed to the acid form before the tubers of the 1942 crop developed. The incidence of scab on potatoes grown in the sulfur-treated soils will be determined in 1943 and 1944 to find out the duration of the benefits from the sulfur treatment.

### A New Irish Potato Disease Threatens Growers of Western North Carolina

A new potato disease believed to be purple top or blue stem is rapidly becoming a menace to the Irish potato growers of western North Carolina. The brown, stem-end, new-necrosis of tubers characteristic of the purple top disease was found in many lots of seed potatoes grown for certification. The disease was prevalent and serious in Henderson County. A sample of table stock examined in an Asheville wholesale store had 80% of the tubers affected. Lots of seed grown in Yancey and Watauga Counties had 38 and 30% of the net-necrosis, respectively. Circumstantial evidence suggests that the disease spreads rapidly from infected plantings to neighboring plantings, and that the dissemination is probably accomplished by insects.

### Precooling Irish Potatoes Helps Control Rots During Shipment

A series of tests made on precooling refrigerator cars with bunker fans indicated that precooling produced sound, crisp potatoes at the city market. A charge of 2400 lbs. of ice in each bunker provided adequate for precooling. Bunker fans delivering about 3600 cubic feet per minute will adequately precool a car in six hours.

The cost of precooling with bunker fans, including ice, fan depreciation, and installation labor will be about $14 per car.

Initial icing without fans may also prove beneficial. Salting the ice is not worthwhile, as the precooling time is shortened very slightly. Tests on commercial precoolers mounted on truck chassis indicated that they adequately precool potatoes in three hours. Growers contracting this precooling should check the drains to the cars and plug them if they are open for they provide free leakage for cold air.

### Increase Yields of Potatoes By Controlling Insects

Insects were not as abundant on early Irish potatoes in the eastern part of the State during 1942, as in the average season. Colorado potato beetle did some damage at Washington where careful spraying with Bordeaux mixture with calcium arsenate increased yields 24.9% over unsprayed checks. Basic copper arsenate gave an increase of 30.1% and calcium arsenate alone gave an increase of 22.8%.

In the mountains frequent and heavy rains interferred seriously with the dusting program. However, pyrethrum-sulphur mixture gave excellent control of the potato leaf-hopper; calcium arsenate and Bordeaux mixture with calcium arsenate gave excellent control of flea beetles on Early Bliss potatoes. Bordeaux mixture with calcium arsenate gave the highest total yield, 41.1% more potatoes than the unsprayed checks.

On the late Sequoias pyrethrum-sulfur and Bordeaux mixture with calcium arsenate gave the best control of leafhoppers. Calcium arsenate alone and Bordeaux mixture with calcium arsenate gave the best control of the flea beetles. Bordeaux with calcium arsenate gave an increased yield of 18.6% more potatoes than the unsprayed checks.

### Control of Pickleworms on Squash, Cucumbers and Cantaloupes

In tests of several insecticides for the control of pickleworms on summer squash, cryolite was the most satisfactory material used. Both a natural and a synthetic cryolite gave good control with no injury to the plants. Barium fluosilicate controlled the insect equally well but caused some burning.

Several insecticides which do not leave a poisonous residue were also tested but none of them proved very satisfactory. The amount of residue on squash and cucumbers is still being investigated. For the control of pickleworms on cantaloupes the question of poisonous residue is of no importance, since the outer part of the fruit is not eaten.

### Vegetable Crops Are Tested for Root Knot Tolerance

In tests at the McCullers Branch Station with a number of vegetable crops planted on nematode-infested land in 1941 and 1942, several varietal differences were noted.

Ten common tomato varieties were all severely affected but in some cases variations were evident. In comparatively lightly infested soil following cotton, Gulf State Market produced, 4.4 Pearson, 2.9, and Morse, 2.1 tons of marketable fruit per acre. All varieties showed equally severe root knot infestation. On more heavily infested soil following tobacco, Gulf State Market produced, 3.2, and Marglobe, 3.3 tons of marketable fruit per acre. A South American species of tomato **(Lycopersicon peruvianum)**, brought into this country by the Bureau of Plant Industry, was included in the tests and showed rather remarkable tolerance to the disease as compared with common varieties. In 1942, on heavily infested land, three selections of this species showed an average root knot severity rating of 10.6 as compared to 90.6 for Marglobe, 85.8 for Gulf State Market, and 88.7 for San Marzano. An average of 45.2 per cent of the plants were affected as compared to 100 per cent for all other varieties tested. An attempt is being made to cross L. peruvianum with the common tomato.

Iron cowpeas, although attacked by the root knot nematode showed marked tolerance over other varieties tested. Fusarium wilt was rather severe on cowpeas in the test plots and a positive correlation was found to exist between root knot severity and percentage of plants affected with wilt, indicating that attack by the nematodes renders the plants more susceptible to invasion by the wilt fungus.

Of 15 varieties of edible soybeans planted in 1941 in heavily infested soil, Easycook showed the least severe root knot. In less heavily infested soil in 1942 it was again lightly attacked but was not significantly more tolerant than several other varieties.

### Progress Made In Control of Lettuce Damping-Off

A number of fungicidal materials applied to the soil both before and after seeding show promise in controlling post-emergence damping-off of lettuce while seed treatment appears to be effective against the pre-emergence phase of the disease.

Of several pre-seeding soil treatments tested, formaldhyde and chloropicrin showed the most promise. While neither treatment completely prevented damping-off, better stands and increased numbers of healthy plants available for setting in the field were produced on plots treated with these materials. Soil treatments, when applied prior to seeding, with Yellow Cuprocide, Semesan, Semesan Bel, Spergon, and Urea either resulted in reduced germination or did not effectively control the disease.

Post-emergence treatments with solutions of Semesan, Semasan Bel, and Yellow Cuprocide sprinkled directly on the plants were all somewhat effective against the disease. In plant bed plots treated with these materials the per cent of damping-off was substantially less than in untreated plots, but in some instances resulted in slight injury to the plants. The injury was most pronounced when the chemicals were applied during periods of abnormally low temperatures.

Seed treatment tests conducted in 1942 indicate that pre-emergence seed decay and damping-off can be largely prevented by treating lettuce seed. Substantially increased stands resulted from treatment with several materials, of which Yellow Cuprocide and Spergon were outstanding. The results indicate that seed treatment, which is not generally practiced by North Carolina lettuce growers, is economically practical.

# LIVESTOCK AND POULTRY

## Beef Cattle

### Is Cottonseed Meal Needed To Supplement Grass Hay In Winter Ration of Yearling Steers?

In a three-year trial conducted in Avery County with yearling beef steers one group was wintered entirely on meadow grass hay while the other group received two pounds of cottonseed meal per head daily in addition to the hay. In the feeding period extending from about the first of December to the beginning of the grazing season, around April 20th, the group wintered on hay alone lost an average of 0.41 pounds per head daily as compared to an average daily gain of 0.14 pounds in the group receiving cottonseed meal. The average daily gains on pasture were 2.01 pounds in the hay group and 1.68 pounds in the cottonseed meal group. Thus, the gains on grass were so much greater in the hay group that by the end of the grazing season these steers averaged only eighteen pounds less per steer than the cottonseed meal group. An average of 270 pounds of cottonseed meal was consumed per steer during the wintering period. The additional gain of only 18 pounds per steer would not usually justify this expenditure.

### Burning of Forests Harmful To Cattle Grazing[1]

Recent studies at the Blackland Branch Station show that fires delay the grazing season about two weeks in the spring in the reed-type of forage. This reduces the carrying capacity of the pastures the following year, and causes the reeds to be more easily killed by grazing.

The reeds were burned off the latter part of March before the grazing season started in May, the pastures were grazed at two different rates of stocking, and the test was carried out in duplicate. There was no appreciable difference in rates of gain of the bred two-year-old heifers on the burned and unburned areas.

### Cut-over Timber Lands In Piedmont Furnish Good Spring Grazing for Beef Cattle

Tests conducted at the Animal Husbandry Farm near Raleigh show that cut-over timber lands can be used advantageously to fill in the grazing gap between winter annuals and lespedeza. On tests conducted during the last three years beef cattle made an average daily gain of 1.21 pounds in the period from about the middle of April to the last of May. If these cattle were returned to the woods pasture for two weeks longer grazing each year the gains for this last period were very poor or in some cases even a slight loss occurred. The best gains were for the first four weeks. The area was grazed at about the rate of three yearlings to five acres. The forage consisted chiefly of hardwood browse and native woods grasses.

Studies conducted by the State College Forestry Department covering the grazed area and a similar ungrazed area show that after grazing for approximately two months each spring for three years the grazed land contained 83% more young pines (6 inches in height or more) per acre than the ungrazed land.

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[1] Cooperation: Bureau of Animal Industry and Forest Service, U. S. Department of Agriculture.

# Dairy Cattle

### Dairy Farming Pays In North Carolina

Dairy farming is an expensive but profitable business for North Carolina farmers. These facts have been established by an exhaustive study of 89 dairy farms covering the calendar year of 1941. The average gross receipts for these farms was $6,850. Of this amount dairying contributed $4,863, or 71% of the total receipts from the farm. On the other hand, the average operating expenses were $5,138. The average return over operating expense was $1,720. This was the reward the farmer received for his own labor, management, and interest on his investment. In addition to this income the farmer received $690 in the form of privileges. The interest earned was 4.4% on the total investment.

Not all of these dairy farmers were successful. The most successful farmer made a labor and management wage of $6,028, whereas the least successful farmer made a minus income of $2,448. The range in income was due to the size and quality of the herd, and to its management. The most significant factor affecting success was the amount of milk sold per cow. On farms where the production per cow was less than 5,000 pounds, the milk cost $3.79 per hundred pounds. When the production average 6200 pounds or more the cost was reduced to $2.64 per hundred pounds. These facts indicate that the quality of the cow is one of the most important single factors affecting returns.

### Sweet Potato Silage Makes Milk[1]

Sweet potato silage, made of vines and potatoes and put up in Sisal-Kraft silos, was equal to or better in feeding value than a good grade of corn silage with which it was compared. The carotene content was 83% greater than corn silage, protein 33% higher, fiber 27% lower and nitrogen-free extracts 6.8% lower. Compared to the raw material at the time of ensiling, the silage itself suffered no appreciable loss in nitrogen-free extract (1.9%). The protein loss was 4.4% while carotene increased 52%.

Feeding trials were begun in January, 1942. Comparable groups of five cows each were fed sweet potato vine silage in comparison with corn silage. At the end of a thirty-day feeding period the following results were obtained:

| Kind fo Silage | Initial Weight (Five Cows) Lbs. | Production Lbs. | Fat Lbs. | Final Weight Lbs. |
|---|---|---|---|---|
| Sweet potato | 5,152 | 4,513.8 | 190.9 | 5,161 |
| Corn | 5,236 | 3,892.7 | 161.2 | 5,319 |

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[1] Cooperation: Bureau of Agric. and Industrial Chemistry, U. S. Department of Agriculture.

During the spring of 1942 the digestibility of sweet potato silage was determined with dairy cows. The average total digestible nutrients were 26.9%. Of the protein, fat, carbohydrate and fiber in the silage, 57.0, 70.3, 87.3 and 75.3 per cent, respectively, were digested.

In terms of milk and fat production it is obvious that sweet potato silage as a feed for dairy cattle compares very favorably with corn silage.

Something of the importance of this work to North Carolina Agriculture may be gained by a consideration of the following: (1) North Carolina ranks among the first in the United States in the production of sweet potatoes; (2) over 100,000 troops are stationed in Eastern North Carolina. Defense needs for milk and milk products have only aggravated the situation in a state which does not produce enough milk for its own people; (3) thousands of tons of sweet potato vines go to waste each year. These vines, converted into silage, along with strings and culls, will provide an important feed supplement and be of material aid to the Dairy Industry.

### Cottonseed Hulls and Molasses More Economical Than Beet Pulp for Milk Production

During 1938 and 1939 the feeding value for milking cows of beet pulp as compared to a 75% cottonseed hulls—25% molasses mixture was determined. Four groups of 10 cows each were used in the comparison. Each year the cows were fed 105 days, divided into three periods of 35 days each, using 5 days of each period for change of rations, and alternating between the hulls-molasses and beet pulp rations.

The results of this experiment show that the palatability and physiological effect of the hulls-molasses mixture and beet pulp were about equal. The hulls-molasses mixture proved to be more economical for milk and butter-fat production.

### Summer Decline In Milk Production Not Directly Related to Temperature[1]

The body temperature of ten lactating dairy cows was taken twice daily (7:00 a.m. and 3:00 p.m.) from June 6, 1942, to September 30, 1942, at both the Central Station Farm and the Lower Coastal Plain Branch Station. These body temperatures have been correlated with milk production records. These studies indicate that the decline in summer milk production in North Carolina due to atmospheric temperature has been over-exaggerated. More information is being accumulated on this important subject.

### Does the South Have Smaller Cattle?

It is the generally accepted belief, among many, that dairy cattle are smaller in the South than in other sections of the country. Measurements and weights of all calves born in the College dairy herd are taken monthly on each calf from birth to maturity. Data collected to date show that the North Carolina State College Dairy herd exceeds the Missouri Weight Standard by 2.2%.

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[1] Cooperation: Bureau of Dairy Industry, U. S. Department of Agriculture.

# Hogs

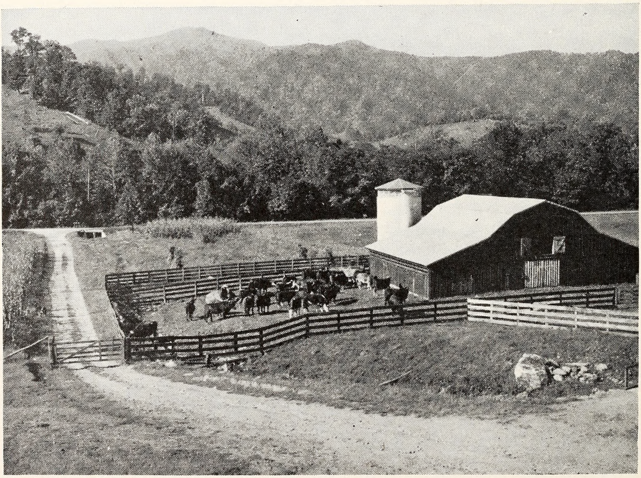
## Protein Content of Feed Important In Swine Feeding

The beneficial effect of feeding a supplement of plant origin that is high in protein content was demonstrated in two trials at the Blackland Branch Station, Wenona, during the current year (1942). Sixty 84-pound pigs were fed to an average final weight of 219 pounds in the first trial; in the second trial, forty 98-pound pigs were fed to an average weight of 226 pounds. In each of these two trials the pigs were divided into two groups and self fed, free choice, white shelled corn, protein supplement, and mineral mixture. In each trial the protein supplement for group I consisted of equal parts by weight of 50% tankage and 36% cottonseed meal, while group 2 was fed a protein supplement consisting of equal parts of 50% tankage and 41% peanut oil meal. The results from both trials were quite similar. The pigs in group 2 made more rapid gains and consumed less feed per unit of gain, apparently because of the higher protein content in the ration fed. However, the protein content of the supplement did not affect the amount consumed, since in both trials, there was less than one-half of one per cent difference between groups 1 and 2 in the consumption.

## Raw Soybeans Deficient In Critical Amino Acids

Experiments conducted during the summer and fall of 1942 have shown that young pigs averaging 40 lbs. each at the start of the

FIG. 22. CATTLE BROUGHT IN FROM MOUNTAIN PASTURES FOR WINTERING



experiment do very poorly on a ration containing a large percentage (78.5) of raw Tokio soybeans, even when the ration is supplemented with alfalfa, tankage, cottonseed meal and a complete mineral mixture.

The above ration was shown to be adequate with respect to carotene (provitamin A), vitamins of the B-complex, trace elements and other minerals. The growth depressing effects of the ration were not entirely due to the high oil content of the beans since feeding of a fattening ration supplemented with 0, 5, 10, and 15 per cent soybean oil resulted in good growth. Decreased appetites and gains were evident at the higher oil levels, but the gains were much better than those obtained on the basal soybean ration. From the standpoint of growth and appearance, the addition of 5 per cent oil seemed to improve the fattening ration.

Results to date indicate that the protein of raw soybeans is incomplete for pigs. This is thought to be due to the lack of the two essential amino acids, cystine and methionine. Attempts are now being made to find supplements which, combined with raw soybeans, furnish protein mixtures of good quality for pigs.

# Nutrition

### Blood Samples Show Condition of North Carolina Cattle

During the summer and fall of 1942, blood samples from 500 dairy and beef cattle, representing thirty farms and from widely scattered areas in the State, were studied for their calcium, phosphorus, carotene and hemoglobin contents.

Calcium and phosphorus values were normal throughout, i.e., in agreement with the values found to be normal in other states. Inasmuch as pasturage had been generally good, the blood carotene values, as might be expected, were normal. However, there were a few isolated cases in which dairymen were grazing too many cattle on too small an acreage, and were feeding roughages such as badly bleached corn fodder and stover of low carotene content. Blood carotene values were extremely low in these cases.

The most striking finding in these studies was that hemoglobin values of most cattle in the State were generally low. Values ranged from 7-10 grams per 100 cc., whereas normal values should range from 10-12 grams per 100 cc. These low values were common in all sections of the State.

Because of the present great demand for milk, it appears that some dairymen, in their desire for temporary profits, are trying to carry more cows in their herds than they are equipped to handle. There is a tendency on the part of some to feed too cheaply and scantily with the feeds available.

### Fertilized Pastures Keep Cows Longer

The fertilization of Halewood mountain soil with one-half, one and two tons of limestone per acre, and three types of T.V.A. phosphates, triple superphosphate, fused rock phosphate and calcium metaphosphate, produced the following increased yields of nutrients for livestock during the dry summer of 1941.

|  | Increase per Acre | Increase per ton of Hay |
|---|---|---|
|  | Pounds | Pounds |
| Dry Matter | 272 | . . |
| Protein | 56 | 32 |
| Calcium | 1.83 | . . |
| Phosphorus | 0.92 | 2.42 |
| Carotene (vitamin A) | 0.37* | . . |

* Ounces

As indicated, the increases in plant nutrients due to fertilization can be conveniently illustrated by the number of days that these increases will maintain a 1,000 lb. cow. The increase in dry matter was enough to keep a cow enough extra calcium was produced to last 141 days. Enough additional vitamin A is provided to maintain a cow for almost nine months. There was enough extra phosphorus to last the cow 40 days.

### Soybeans Retard Growth In Rats

When soybeans are the only source of riboflavin in a diet for rats, an increase in the amount fed daily from one-quarter of a gram to three-quarters of a gram does not result in an increased growth rate. The larger amount of soybeans may so change the protein in the ration that the rats do not receive enough of the sulfur containing amino acids, methionine or cystine. It is also possible that the riboflavin of soybeans is not completely available. The possibility that cooking may increase the availability of the riboflavin is being investigated.

Since the availability of the riboflavin of foods may differ widely, the use of chemical or physical methods will not in all cases provide as accurate a measure of available riboflavin as would a rat assay. Chemical and physical methods would show the total amount present regardless of its availability to the animal.

### Fats and Oils Differ In Value

Recent experiments have shown that rats make distinctly poorer gains when a refined vegetable oil is substituted for the hydrogenated fat usually used in a basal ration employed in assays for riboflavin. This suggests that not only the amount but the kind of fat are important considerations in studies concerned with the utilization of riboflavin by the rat.

With every prospect that fats and oils will soon be added to the list of rationed foods, any new information regarding the relative merits of different types of fats and oils may have an important bearing on the national welfare.

### Sunlight Destroys Riboflavin Vitamin $B_2$ In Milk

Recent studies at the North Carolina Experiment Station have shown that riboflavin, one of the vitamins of the B-complex, is rapidly destroyed in milk when the milk is exposed to sunlight.

Milk samples in standard bottles were exposed to direct sunlight for various lengths of time. In one hour the loss in riboflavin amounted to as much as 44%. After three hours only 28% of the original riboflavin of the milk remained.

Riboflavin deficiency may well prove to be one of our most serious deficiencies since many foods contain very little of this vitamin. Green leafy vegetables, the whole cereal grains, liver, eggs, milk, and yeast are rich in the vitamin, but foods such as butter, fats of all kinds, unenriched flour, and white potatoes are practically devoid of the vitamin.

Milk and meat are the important sources of this vitamin in the human diet and may provide from one-half to all of one's daily requirement for riboflavin, depending on the amount consumed.

This work suggests that when milk is delivered it should be placed in a cool, dark place as soon as possible in order that the riboflavin will not be destroyed.

# Turkeys and Poultry

### More Profitable Poultry Can Be Developed By Careful Breeding

Studies at the Central Station Experimental Plant and at the Lower Coastal Plain Branch Station at Willard show that more profitable poultry can be developed through selection of breeders on the basis of family performance. In three years the flock egg production average of Rhode Island Reds (six months of lay) at Raleigh was increased from 111 to 130; at Willard from 97 to 116; and Barred Rocks at Raleigh from 106 to 111. Days from time of hatch until the first egg was laid (sexual maturity) were decreased in the Reds at Raleigh from 227 days to 207 and in Rocks from 200 days to 184. Adult mortality during the first six months of lay at the Central Plant was reduced in Rhode Island Reds from 17.5% to 2.9% and in Rocks from 24.5% to 3.8%. Average March egg weights of all flocks were over the standard in all flocks studied.

### Mortality of White Leghorns Further Reduced By Breeding

A further decrease in general mortality in White Leghorn pullets has been accomplished by using breeders from families having had very few or no losses by death.

Pullets trapnested during 1941-42 came from six pen matings (selected matings) which used breeders from families having shown superior livability in previous years, and from two pen matings (control matings) which used breeders from families having had average or below average livability records. Each pen mating consisted of one cockerel and from six to eight hens.

| | CONTROL MATINGS | | | SELECTED MATINGS | | |
|---|---|---|---|---|---|---|
| Year | Number of pullets | No. alive at 12 mo. | Percent living | Number of pullets | No. alive at 12 mo. | Percent living |
| 1939 | 208 | 137 | 65.9 | 530 | 366 | 69.1 |
| 1940 | 160 | 108 | 67.5 | 349 | 280 | 80.2 |
| 1941 | 114 | 82 | 71.9 | 511 | 454 | 88.8 |

Selection for improved livability has been practiced for three years. The selected matings have shown a steady improvement in livability as compared with the control matings:

Pullets from one mating were especially outstanding in livability. Of exactly 100 pullets at the beginning, all except three were alive and laying at one year of age. Of these three, one was culled for late maturity, one died at 359 days, and the other at 352 days.

Improved livability has not been developed at the expense of other factors. Body-weight and egg-size have shown slight increases, and pullets from selected matings showed an average production during the first six months of laying of 115 eggs.

These results demonstrate to the poultry breeder the importance of emphasizing livability in the breeding program, and to the general poultryman the value of obtaining stock which has been bred for superior livability.

### Crossbred Broilers Outweigh Purebreds

In seventeen groups of crossbred and purebred broilers grown in 1942, including purebred Rhode Island Reds, Barred Plymouth Rocks, and White Leghorns, and six crosses of these breeds, only one group of purebreds was as heavy as the related crossbreds.

The Rock-Red crossbreds (Barred Rock male and Rhode Island hens) showed an average excess in weight of five and a half ounces over purebred Reds and five ounces over purebred Rocks. Even the crossbreds having Leghorns as one parent were heavier at ten weeks than the purebred Reds and Rocks. These results indicate that where a shortage of broiler chicks exists, satisfactory results can be expected by cross-mating Leghorn supply flocks. This would not be desirable where the appearance of Rock-Leghorn and Red-Leghorn crossbreds causes them to suffer discrimination when sold on the live market. Rock-Leghorn crossbreds are almost entirely white with a very few dark flecks, while Red-Leghorns are predominantly white but contain variable amounts of red in the plumage.

All crossbreds were fully feathered at ten weeks and in less time than required by the purebred Reds and Rocks, many of which were not fully feathered at ten weeks. Differences in mortality were not great, but the percentage was lower in all groups of crossbreds than among the purebreds.

### Colds In Chickens Studied

Recent experiments have resulted in the development of a suitable medium in which the cold germ **(Hemophilus gallinarum)** will grow well. It is expected that this medium will greatly aid in the study of the germ.

Infectious coryza, or colds, is a destructive and profit-reducing disease which occurs in many North Carolina poultry flocks. Although a germ **(Hemophilus gallinarum)** was found in 1932 to be responsible for the disease, investigators were able to learn but little because of the difficulty of growing it in artificial culture mediums. The cultural characteristics of the coryza germ have been studied and at present studies are in progress on immunity in infectious coryza. It is possible a vaccine may be produced which will be of value in controlling the disease.

### Breeding for Resistant to Coccidiosis a Promising Possibility

In 1938 it was observed that in some families all or a large portion of the chicks died of cecal coccidiosis but that in other families none died when a natural outbreak occurred in these chicks. In the spring of 1939 some of the parent birds of these families were mated again to test the progeny for susceptibility or resistance to this disease. This was carried out by artificially infecting the young chicks with the disease-producing agent. While the numbers used were small, the two groups of chicks differed in the proportion of inoculated birds which died. The possibility of breeding for resistance to this dread chick disease seemed quite promising.

During the past year more work has been done on this problem with new matings. Twenty-two matings, yielding some 490 chicks, were made and these progeny were tested by artificial infection for resistance or susceptibility. The results of this progeny testing showed a variation in resistance, some families possessing quite high resistance, some being quite susceptible and some intermediate.

It is anticipated that by the use of certain families selected from the above and the progeny saved from these matings, more promising and definite results will be obtained in studies now under way.

### Growing Chicks With Less Tapeworms

Results from a preliminary experiment to determine a good way to raise young chicks to broiler size with as few tapeworms as possible indicate that baby chicks kept in brooder cages for five weeks and then let out on range for five weeks show a highly significant reduction in the number of birds infected with worms as compared with chicks kept on the floor of the brooder house for ten weeks. Also such chicks show the same marked reduction in percentage of birds infected as compared with chicks which are permitted free range throughout the entire ten weeks of the experiment. There is no significant difference between the percentage of infected birds of the confined group and the group permitted free range.

Other studies indicate that chicks raised during the late spring are more heavily infected with worms than when raised in the fall of the year. A survey of 500 chickens from different parts of the State has been completed and the results show that approximately 50 per cent of the examined birds were infected with tapeworms. The insect carrier of the most prevalent tapeworm is a small, brown ant. Beetles and flies serve as carriers of other species of tapeworms in the State.

### Is It Profitable To Save Turkey Hens for Breeders Beyond the First Laying Year?

The Broadbreast Bronze turkey hen in Figure 23 laid 167 eggs in the first year, 79 eggs in the second, and 99 eggs in the third laying year, thus having a total of 345 eggs. This bird has been an excellent breeder and has consistently produced a progeny which performed well. This bird comes from one of the superior families developed at the Turkey Experiment Farm. One hundred fifteen toms from the best families have been distributed to turkey farms in the state to improve the breeding of turkey flocks.

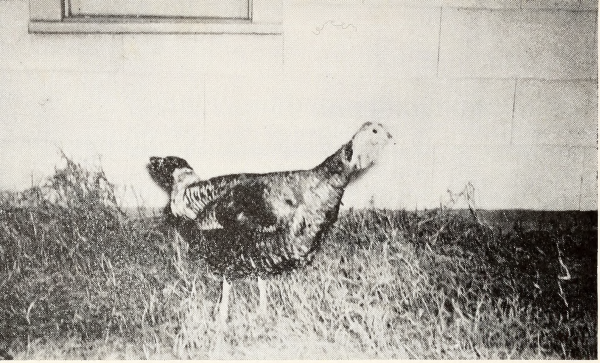


FIG. 23. BROADBREASTED TURKEY HEN WITH A HIGH RECORD.

### Experimental Studies Develop Promising Methods of Control of Paratyphoid in Turkeys

Experimental studies at the Central Station Experimental Plant are seeking to determine what type of paratyphoid infection is found in North Carolina turkey flocks; how the infection is spread; and how it can be controlled. This bacterial disease is quite prevalent and very destructive to young turkey poults. Its presence on a turkey farm may be perpetuated unless proper methods of control are rigidly applied.

The results from several groups of naturally and artificially infected birds have been studied and from them 347 recoveries of the disease-producing organism have been identified (culturally and serologically). They were all identified as Salmonella typhi-murium.

The disease is spread through the body discharges (excreta) of adult carrier birds of the breeding flock. The litter, water containers, feed containers, and other equipment as well as the soil may become infected. Periodic re-infection may take place unless such carriers are detected and removed. The adult carrier bird usually shows no external evidence of being sick and can be detected only by a suitable blood-test.

In the poults, there is a possibility of transmission from parent to offspring chiefly because of shell infection rather than from infection of the egg content. After hatch, the poults may readily contract the disease through contaminated feed, litter and water.

Control measures include the following: (1) Extremely rigid sanitation must be practiced where the disease exists or has existed on the premises; (2) All adult birds should be tested by the tube method, using the specific "H" antigen (blood-testing fluid) which was developed during the course of these studies and which has proven highly effective in detecting carrier birds; (3) All turkey eggs used for hatching purposes should be carefully fumigated.

# SOILS AND FERTILIZERS

## Soil Conservation

### A New Row System for Terraced Land[1]

The common practice in laying out rows with field terraces has been to have all rows parallel the upper terrace, with any point rows emptying into the channel below. Serious faults are noticed with this system, however, as slope changes cause row grades to reverse in widening sections of the interval. This concentrates row water from both directions at narrow points of the interval and causes row breakage and terrace silting.

Figure 24 shows an improved row system which has been developed and is being observed on the Soil Conservation Experiment Station. The new system provides continuous row drainage in the direction of the terrace flow and appears to have a decided advantage over the conventional method. The principle of this method is that all rows parallel the upper terrace in narrowing sections and parallel the lower terrace in widening sections. One guide row is laid out first for each interval, and all other rows parallel the guide row.

Simple directions for laying out this improved row system have been prepared, with diagrams showing location of the guide row and the completed system.

Encouraging reports have been received from the farm trials of the new system, and it is to be used further on a field trial or demonstration basis.

### Save and Use Organic Materials Found on Most Farms[1]

The beneficial effect of manure, compost, and woods litter in controlling soil loss and increasing cotton yields is clearly shown in Figure 25. Results shown are for a 4-year period at the old Statesville Soil Conservation Experiment Station. While heavy applications of organic material may not be practicable, the data emphasize the wisdom of saving and using crop residues and other organic materials found on most farms.

### Statesville Results Show Protective Effect of Land Covers[1]

The vulnerability to erosion of bare land and row-cropped land and the protection afforded by annual lespedeza, permanent sod, and woodland are shown in Figure 26, which is taken from a summary report of results secured at the Statesville Soil Conservation Experiment Station. These results emphasize the wisdom of keeping highly erodible land in sod or in trees, and in planning protective rotations for row crop land.

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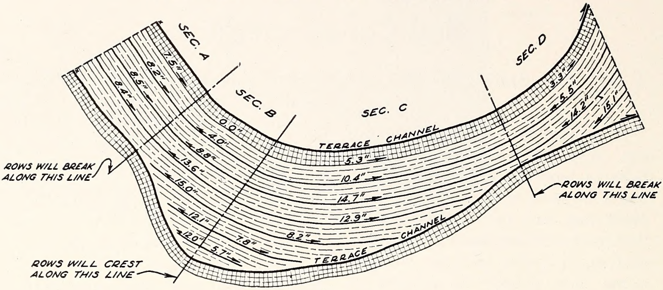
[1] Cooperation: Soil Conservation Service, U. S. Department of Agriculture.

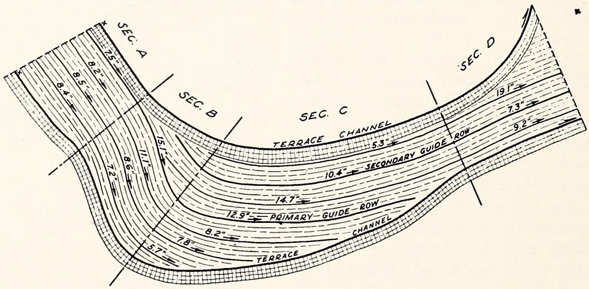
[1] Cooperation: Soil Conservation Service, U. S. Department of Agriculture.

CONVENTIONAL ROW SYSTEM
COMMONLY USED ON TOBACCO LAND



NOTICE DECREASE AND REVERSAL IN ROW GRADES IN SECTIONS OF THE INTERVAL WIDENING TOWARD THE OUTLET. THIS IS THE SAME INTERVAL AS IN FIGURE 2 BELOW.

DIAGRAM OF IMPROVED ROW SYSTEM
PARTICULARLY APPLICABLE TO TOBACCO FIELDS



CONTINUOUS ROW DRAINAGE AS INDICATED BY THE GRADES SHOWN, BY ROWS PARALLEL TO THE UPPER TERRACE IN NARROWING INTERVAL (SEC. C). AND PARALLEL TO THE LOWER TERRACE IN WIDENING INTERVAL (SEC. B & D). DIAGRAM IS AN ACTUAL STADIA SURVEY OF A TERRACE INTERVAL WITH TERRACES LAID OUT ON A 6" GRADE.

FIG. 24. ROW SYSTEMS FOR TERRACED LAND.

# Soils

## Soil Surveys Being Widely Used[1]

During the current year soil surveys and reports of Buncombe and Graham Counties have been completed. A reference copy of the field map has been supplied each of the respective County Extension Agents. Reports and maps of

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[1] Cooperation: Tennessee Valley Authority and Bureau of Plant Industry, U. S. Department of Agriculture.

Madison and Warren Counties have been published and free copies are available.

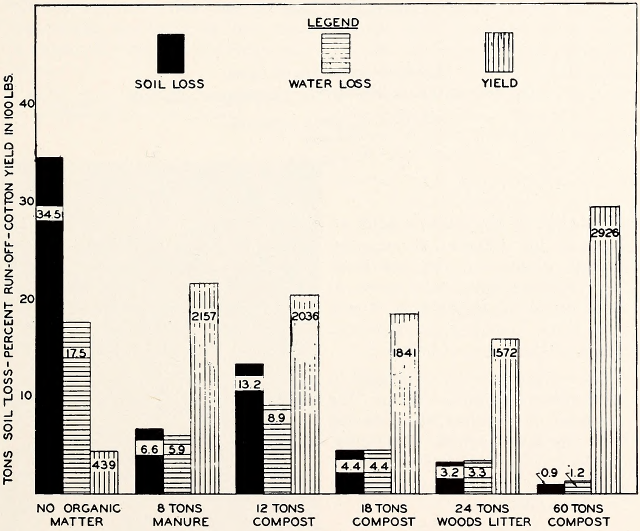
Repeated requests from the War and Navy Departments have called for maps and reports of every soil survey in the Coastal Plain area, and also for specific soils data as well as a general soil map of the State. These maps apparently are being used for locating sites for military establishments, and for planning military maneuvers.

The soil survey provided the basic principles used in allocation of production goals by counties for the oil crops so essential to the war effort. Soils were grouped showing the acreage of lands now under cultivation (1) that are well suited to the growing of soybeans and peanuts, and (2) that may be considered as only second choice for these two crops.

In the mountain area of the State maps have been made of the fifteen counties showing (1) agricultural land, (2) non-agricultural land, and (3) doubtful agricultural land. These classifications and recommendations for land use, cropping systems, fertilizers, and erosion control practices are based on the soil survey and coupled with

FIG. 25

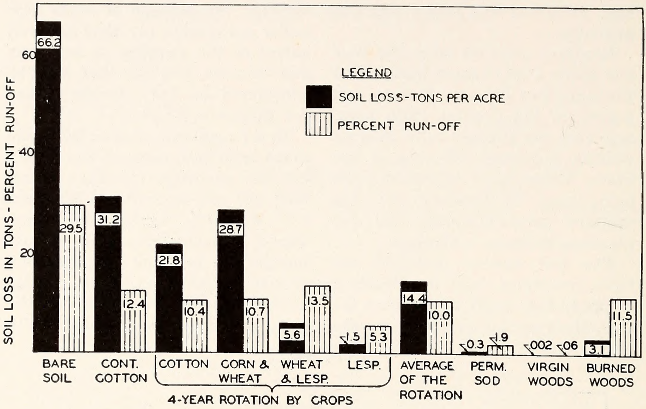
EFFECT OF ORGANIC MATTER ON SOIL AND WATER LOSS AND YIELD



SUMMARY OF RESULTS FROM
SOIL AND WATER CONSERVATION EXPERIMENT STATION

STATESVILLE, NORTH CAROLINA
1937-1940

SOIL AND WATER LOSS FROM VARIOUS CROPS AND LAND COVERS.



SUMMARY OF RESULTS FROM
SOIL AND WATER CONSERVATION EXPERIMENT STATION
STATESVILLE, NORTH CAROLINA
1931-1938
FIG. 26

knowledge of the various soils as obtained by different treatments. Special community and individual farm surveys have been made in great detail for application of certain farm management practices based on character of soil.

County soil surveys were used in determining suitable farms for purchase by families being moved from the areas subject to inundation by Chatuge and Fontana power development projects in western North Carolina.

### Proper Method of Liming Essential for Good Plant Growth and Nutrient Conservation

When lime is added to the surface few inches of a soil a long time is needed for the neutralizing effect to penetrate through the entire plowed layer. Outdoor experiments have shown that when part of the lime is incorporated deeper, better crop growth and root distribution is obtained than if all the lime is added to the surface 4 inches. This effect is illustrated in Figure 27.

It was also found that a higher level of lime of the subsoil reduced very markedly the loss of potash and magnesia. This conservation of plant nutrients can probably be attributed to two causes, namely: (1) better root distribution, making the plant nutrients positionally more available and (2) greater retention of potash and magnesia by the less acid colloidal materials.

### Nitrogen Is Released Rapidly By Some Legumes[1]

During the summer of 1942 nitrate and ammonia determinations were made at three times on soils planted to tobacco in a series of rotation plots at the Oxford Station. At the first sampling on June 12 there was a wide variation in the nitrate content of the soil, with the vetch, lespedeza and crimson clover plots containing more than the soybeans, cowpeas or fallow plots. By the last of July the nitrate level was very low and almost a complete reversal of order occurred—the vetch plot was lowest and the fallow plot highest. At the third sampling August 28 the nitrate content of all plots was essentially the same at less than a pound of nitrogen as nitrate per acre.

The nitrogen as ammonia was also quite variable at the first sampling, ranging from about 25 pounds per acre in the vetch plot to about one-half that much in the fallow one. A considerable decrease occurred by the last of July in the vetch plot with smaller decreases in the lespedeza, soybean and weed plots. The fallow and cowpea plots showed almost no change, while the crimson clover plot showed a slight increase. These data indicate that nitrogen was released very rapidly from vetch, soybeans and lespedeza.

Farmers are reluctant to grow legumes in rotation with tobacco, believing that the legumes supply too much nitrogen for consistent production of good quality tobacco. These data suggest that with proper adjustments of cultural practices and proper fertilization good tobacco can be grown in rotation with legumes. See page .... ("Root Growth Increases Tobacco Yield and Value.")

### Winter Cover Crops Prevents Loss of Nitrogen[1]

At the McCullers Station applications of as much as 1000 and 2000 pounds per acre of Uramon were applied about the first of October to determine its effect on root knot control. Observations the following June showed nitrogen deficiency symptoms in the tobacco which had been fertilized with 0-10-12. Analyses of the soil showed that relatively small amounts of nitrate and ammonia

(Continued on Page 74)

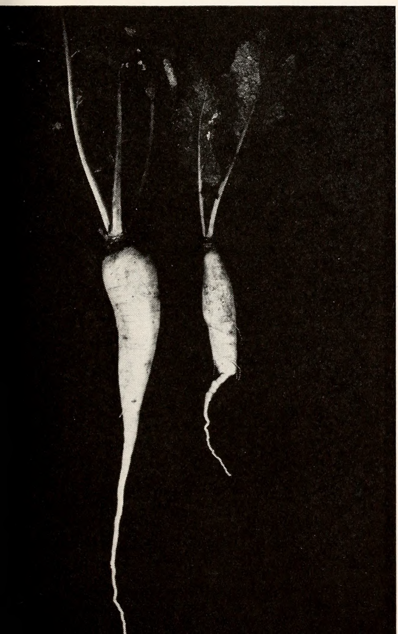


FIG. 27. DIFFERENT METHODS OF LIMING PRODUCED THESE RESULTS WITH TURNIPS. THE ROOT AT THE LEFT IS REPRESENTATIVE OF THOSE WHICH WERE PRODUCED WHERE LIME WAS INCORPORATED TO A DEPTH OF 7 INCHES AND AT THE RIGHT WHERE LIME WAS INCORPORATED TO A DEPTH OF 4 INCHES.

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[1] Cooperation: Bureau of Plant Industry, U. S. Department of Agriculture.

[1] Cooperation: Bureau of Plant Industry, U. S. Department of Agriculture.

# ECONOMIC AND SOCIAL PROBLEMS

## Economic Problems

### Cost of Production Credit Still High In North Carolina

A study of credit conditions in three North Carolina counties has revealed that cost of credit to farmers for operating expenses are still high, although it has been reduced in recent years. The most expensive form of short-time credit has been furnished by supply merchants. In 1940 the average charges for time purchases correspond to an interest rate of no less than 33.98% per annum. In comparison, the cost of loans for the production credit associations are much cheaper. For the average loan from this source the farmers pay 8.94% in Wake County, 8.01% in Johnston, and 10.15% in Guilford. Even so, the relative cost of Production Credit Association loans is higher than the official rate of 4.5% indicates. The difference between the actual rate and the official rate is due to the practice of changing, in addition to the interest, certain service fees which are collected in advance. As the amount of these fees does not vary much with the size of loan, small loans are relatively more expensive than large loans. For loans of less than $1,400, bank credit is usually cheaper than credit obtained through the Production Credit Associations. For loans of more than this amount Production Credit Associations constitute a more advantageous source of credit than commercial banks, insofar as cost is concerned. It should not be inferred that any of the credit agencies existing at present should be eliminated. In fact, they all fulfill specific functions in contributing to meet the financial requirements of the farmers. However, the results of the study indicate an urgent need for further investigations of existing conditions in the field of agricultural production credit.

### Higher Prices Needed for Essential Crops[1]

The prices paid in 1942 for peanuts and soybeans, two important war products, were relatively too low. This fact is indicated by a survey of 138 farms located in one of the typical peanut and soybean producing areas of the state. According to this survey, the acre-net returns over material costs for the

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[1] Cooperation: Bureau of Agr. Economics, Division of Farm Management and Costs, U. S. Department of Agriculture.

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(Continued from Page 73)

were present. A higher concentration of nitrate and ammonia was found in the soil to which 3-8-6 was added in the spring than in that treated with uramon in the fall and fertilized with 0-10-12 in the spring.

A rye cover crop conserved the nitrogen, resulting in a larger amount of nitrate and ammonia in the soil at the middle of June. The greater supply of nitrate and ammonia was accompanied by a higher value per acre of the tobacco.

typical crops were: Cotton, $48; tobacco, $326; peanuts for oil, $32; edible peanuts, $45; soybeans, $15; and corn, $4.10. These data indicate that if the 1943 production goals for peanuts and soybeans are to be attained, the prices of these crops must be raised substantially. This is especially significant in view of the general shortage of labor, higher wages, and equipment costs. Under these conditions the farmer will be forced to grow those crops which pay best. It is only by doing so that they can meet the increased cost of production. This does not mean that farmers are not willing to forego some returns in order to meet the nation's demand for oil, but the present prices for peanuts and soybeans appear too far out of line to permit farmers to grow these critical crops in competition with higher priced and relatively more profitable crops.

### Large Farms Important In Peanut Production[1]

The importance of the size of farm in the production of peanuts is revealed by a study of 138 representative farms in Halifax County. For the purpose of determining the importance of size in meeting production goals, these 138 farms were classified into three groups: (1) One-mule farms, under 25 acres of cropland, (2) two-mule farms, 25 to 49 acres of cropland, and (3) large general farms, over 50 acres in crops. The potential production of peanuts for each group expressed in percentage of 1941 acres was 100% for the first group, 117% for the second, and 61% for the last or largest group. On this basis the small farms appear to be potentially the greatest producers. But in this county the small farms include only a small percentage of the total cropland. The first two groups of farms, i.e., those less than 50 acres of cropland, represent only 32% of all cropland. The large farms ranging from 50 acres and over in cropland per farm embrace 68% of all the cropland in the county. This means that, although the small farms are important, the large farms are producing the bulk of the peanuts. These large farms are also potentially the larger producers, although they will not be able to increase their acreage of peanuts relatively as much as the small farms.

### Inefficient Use of Labor on Cotton-Tobacco Farms[1]

A study of representative farms in Franklin County from 1937 to 1939 shows that nearly 75% of all labor was used during a 7-months period from May to November, inclusive. This is the period of planting, cultivating, and harvesting crops in this area. The peak labor load was reached in July and August when tobacco was harvested. (Figure 1.) Cotton and tobacco competed seriously for labor during the fall months. Both of these crops competed also with the seeding of fall grain and winter cover crops. Too often this competition resulted in seeding of fall sown crops later than the date recommended for seeding in this area. As a result, the late fall and early winter growth of these crops was insufficient to provide the needed protection of the soil from erosion.

The labor distribution was favorable to the expansion of lespedeza hay. Seeded in the early spring and harvested in the late summer, it competed less for the use of labor than either small grain or cowpea hay, both relatively important hay crops in this area. Since lespedeza normally requires about 50% less labor per acre than other hay crops, its popularity as a source of hay has steadily increased.

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[1] Cooperation: Bureau of Agr. Economics, Division of Farm Management and Costs, U. S. Department of Agriculture.

[1] Cooperation: Soil Conservation Service, U. S. Department of Agriculture.

A much better use of labor, and probably more income, could be obtained if less cotton and tobacco and more small grain and hay were produced. This would permit farmers to have more livestock and produce livestock products for sale.

### Farmers In Soil Conservation Area Improve Farm Practices[1]

A study of annual changes in farm organization on 124 Franklin County farms from 1935 to 1941 shows that, although the average acres cultivated remained constant at 40 acres per farm, there were important changes in the acreage of certain crops. For example, these farmers expanded the acreage of cover crops for soil improvement from an average of 1.6 acres per farm in 1935 to 9.5 acres in 1941. Legume crops, such as lespedeza, crimson clover, and cowpeas, accounted for 5 acres, and rye, grown in the tobacco rotation, slightly less than 3 acres of the total increase.

Increasing emphasis was placed upon hay production as indicated by the increase of 4 acres of hay crops per farm, which was almost double the hay acreage per farm in 1935. The most important increase was in lespedeza hay. There was only a slight tendency to increase crops grown for seed and small grains harvested for grain. The larger acreage of these crops per farm was made possible by two developments, (1) the decline in row crop acreage and (2) the increase in the number of acres double cropped. On the average, the combined row crop acreage (corn, cotton, and tobacco) decreased from 30 to 25 acres. The acreage double cropped per farm increased during this period from one to eight acres. On those farms taking part in the program of the Soil Conservation Service, the row crop acreage declined 25%, whereas on the non-cooperating farms this acreage decreased 10%. On the small one-mule farms, however, there was little change in the row crop acreage.

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[1] Cooperation: Soil Conservation Service, U. S. Department of Agriculture.

## Social Problems

### War Affects Farm Labor Shortages

War industries and the armed services have seriously depleted the farm labor supply to a point where the fulfillment of war production goals has been made very difficult. Between December 1, 1941, and May 1, 1942, approximately 50,000 men and boys left the farms of North Carolina. This movement was at the rate of 10,000 each month. About 44 per cent of those leaving entered some branch of the armed services and the remainder entered some nonagricultural occupation. This movement of workers out of agriculture increased in tempo in the latter part of 1942 and the early part of 1943. Consequently, the normal surplus of youth and of underemployed persons on farms has been drained off to the extent that production is far below the capacity of North

Carolina farms as well as below the increased needs of this nation and its allies.

The early war movement of workers from farms was made up of single men without dependents. The single men between the ages of 20 and 45 accounted for 28,000 of the 50,000 migrants; and about two-thirds of these went into the armed services. Only 8,000 married men (20-44 years) left farms during the five-month period, and only one-tenth of these went into military service. The youngsters (14-19 years) made up 12,300 of the migrants, but only 3,600 of these went into the armed services. Only 1,600 of the migrants were from 45 to 65 years of age, and only 100 above 65.

It must be remembered, of course, that, due to high birthrates on farms, thousands of farm youths mature each year and thereby become available for farm work, for nonagricultural work, or for the armed services. For instance, the 207,178 youths (15-19 years old) on North Carolina farms in 1940 are available, allowing for a few deaths, to replace 117,230 youths (20-24 years old) by 1945. This represents a surplus in that age group of about 17,000 each year. The Selective Service people have taken these resources into consideration. Furthermore, it must not be forgotten that each year thousands of urban workers get older and must be replaced to a great extent by migrants from farms. The age distribution of urban workers is such that a deficit of young people, available for replacements, exists.

Some hope for relief is seen in the movement of farm workers, possibly entire families, from subsistence farming areas to commercial farming areas; and in the expansion of commercial farming on small subsistence farms. The Experiment Station is now conducting studies looking forward to a national solution of these problems.

### Youths Leaving North Carolina Farms

During the decade 1930-40 the farms of North Carolina contributed to the state and nation 200,000 more people, above ten years of age, than they received. This loss by migration is equal to 13.5% of the available farm population above ten years of age. In spite of this heavy loss by migration, the rural-farm population above ten years of age gained 9.1%. Had no migration at all occurred during the decade, the increase would have been 26.1%.

The distribution of migrants by counties is shown graphically in Figure 28. The following counties lost more than 5,000 rural-farm people by migration: Wake, Union, Edgecombe, Wilson, Nash, Halifax, Johnson, and Robeson.

Pasquotank, Montgomery, Camden, Pamlico, Dare, and Catawba counties lost more than 25 per cent of their available rural-farm population, above ten years of age by migration. New Hanover, Transylvania, Haywood, Buncombe, Caldwell, Yancey, and Bladen counties gained farm population by migration.

The migration from farms is made up largely of surplus young people for whom there is no place on farms. Ninety per cent of the migrants were between 10 and 30 years of age. The maximum rate of migration occurs between 20 and 25 years of age—the loss amounting to 38% of those available. In 13 counties the corresponding rate of loss was over 50%! Yet, in spite of these heavy migration losses, the number of youth on farms continues to increase because of high rates of natural increase.

More females than males leave farms. The following rates of migration are based upon the rural-farm population above ten years of age:

| Sex and Color | Rate of Net Migration | Number of Migrants |
|---|---|---|
| White Male | — 9% | —45,860 |
| White Female | —11.3 | —55,711 |
| Nonwhite Male | —17.5 | —39,192 |
| Nonwhite Female | —23.8 | —55,331 |

There is a high correlation between population pressure and migration from farms. Considering the group of young white men on farms between 25 and 30 years of age, the data show that 66,000 of these youth were competing for farms and jobs available for only 31,000 in 1930. The surplus of 35,000 youth represents the measure of population pressure. The net result by 1940 was that 24,000 of these white youth left farms and that 42,000 remained to fill the places occupied by only 31,000 in 1930! Even though 38% of these available white youth migrated, the total number of such youth increased 35%. Had there been no migration at all, the number would have increased 113%.

The net migration of Negroes from farms during the 1930-40 decade was 95,000. The **rate** of Negro migration from farms was 21% of the available population, as compared with only 10% for the white population. The rate and amount of Negro migration has increased over the previous decade of 1920-30, when only 72,000 Negroes (net) left the farms of the state. In spite of the heavy migration from farms, the Negro rural-farm population actually increased 1.5% because of the high rate of natural increase. Had no migration occurred, the increase would have been 27.6%.

Not only do more females than males leave farms, but they also leave at younger age levels.

### Rural Leaders: A Major Resource

There is an important relation between the physical and the human resources of agriculture. The development of North Carolina agriculture has meaning and value only in terms of the human and social products of rural life. At the same time the improvement of agriculture must start with human resources. Rural leaders, actual and potential, make up the major human element on which all agricultural agencies must depend.

Surveys of rural leadership are now under way in several North Carolina counties, Johnston and Franklin has been completed. In these two counties 217 white male leaders have been interviewed. The largest group consists of men connected directly or indirectly with farming, either as outright farmers (there are 39 of these) or as agricultural extension workers. The next largest group consists of business men chiefly in towns and villages, almost all of whom are engaged in rural industries or in businesses serving the agricultural and rural-nonfarm populations. Other occupational groups contributing 25 or more leaders are the ministry, medicine, education, and law.

The men holding positions of leadership are almost entirely rural born (92 per cent). Even those who have moved to the small towns of the counties surveyed are regularly in touch with, and interested in, rural affairs. In fact, 75 of 100 nonfarmers having a secondary occupation reported farming as the second occupation.

These men are well educated. Four out of five (80 per cent) have finished high school, and over half (53 per cent) have finished college. All but fourteen have married, and there is hope for some of these, as the single are found largely among the younger leaders! Seven out of ten (69 per cent) own their homes, mechanical refrigeration, and radios, and take daily and weekly newspapers. Almost that many have piped water and bath rooms. About three-fourths have telephones. Such possessions are far above the average for the counties as a whole, and both set an example and are indicative of what men successful in achieving leadership in rural counties have attained economically and in plane of living.

The services of these leaders to their communities are almost as varied as the interests of the men themselves, but the point to be emphasized is that the wealth of leadership in these counties is primarily indicative of leadership resources to be found in every county in the state. Such leaders are already useful, but they are capable of much greater usefulness both in the war effort and in the post-war problems which lie ahead.

### Cotton-Raising Counties Lose Many Negro Tenants

Startling decreases in the number of Negro farms in North Carolina have occurred in the last decade. According to the Federal Census, there was a decrease of 15,145 Negro tenant farms in the state between 1930 and 1940, or 26.5 per cent.

The decrease of Negro tenant farmers in North Carolina reflects similar changes in the whole Southeast, where the number of Negro tenant farms decreased 151,925 in the decade, or 27.7 per cent. This change has been so great as to constitute a virtual rural exodus of Negroes in some areas. White tenant farmers have also decreased in number but to a lesser extent. The Census shows a loss of 71,279 white tenant farms in the decade for the Southeast, or 9.9 per cent.

The combined figures for Negroes and whites indicate that not far from a quarter of a million tenant farm families in the Southeast have left their tenant farms during the decade. The number excludes Texas, which lost an additional 97,198 tenant farms. These figures reveal perhaps one of the most significant changes which has occurred in agriculture in the South since the Civil War.

The decrease of Negro tenant farmers in North Carolina has followed very closely the cotton raising areas. Of a total decrease of 15,143 Negro tenant farmers in the state between 1930 and 1940, a decrease of 11,696 or 77.2 per cent of the total, occurred in the so-called cotton counties. In these counties, which include most of the coastal plain and extend westward across the southern part of the state from the sandhills to the mountains, the decrease of Negro tenants amounted to 31.9 per cent, almost a third of the Negro tenants in this area in 1930. This decrease is probably due to the fact that cotton acreage in the state was reduced something like 57 per cent between 1929 and 1939 and that the total returns on cotton were reduced something like 65 per cent.

Although Negro tenant farms in North Carolina decreased approximately to the same extent that they did in the Southeast as a whole, white tenants in North Carolina did not. There were considerable increases in white tenants in the mountain counties. There were also increases in white tenants in some tobacco raising counties and only slight decreases in others. The increases in these areas offset decreases elsewhere in the state. Although changes in white tenant farms appear to be associated with tobacco raising areas, changes in Negro tenant farms did not follow the tobacco raising areas consistently. Tobacco appears to have been a mainstay for many white tenants, but not for the Negro tenants. Thus, it is difficult to escape the conclusion that conditions in the cotton market have been the most important factor in causing the exodus of Negro tenant farmers.

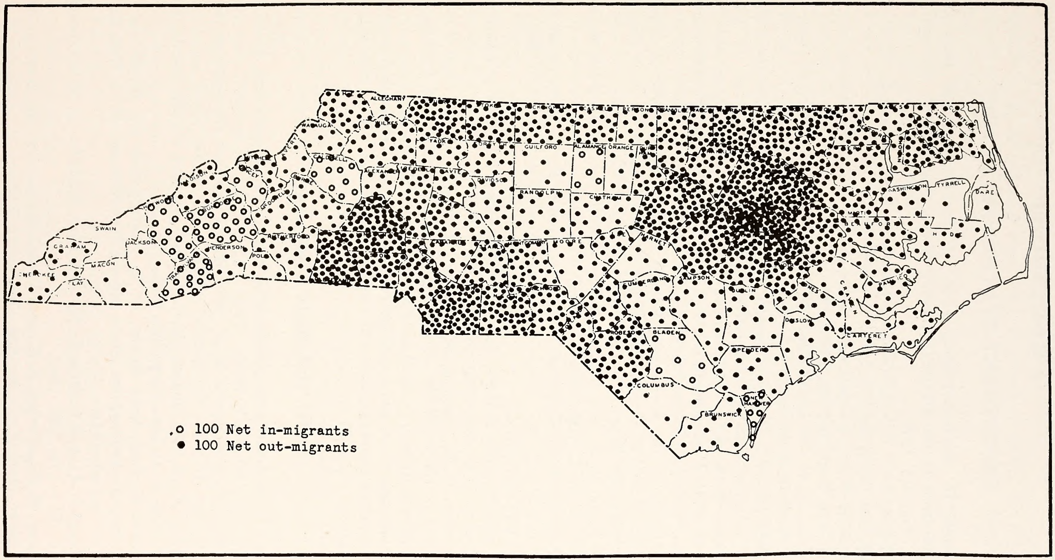

FIG. 28. DISTRIBUTION BY COUNTIES OF 200,000 RURAL-FARM PEOPLE WHO LEFT FARMS BETWEEN 1930 AND 1940.

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| C. D. Grinnells, D.V.M., M.S. | *Associate, Head, Dairy Section* |
| J. O. Halverson, Ph.D. | *Associate, Animal Nutrition* |
| [2]E. H. Hostetler, M.S. | *Associate, Head, Animal Husbandry Section* |
| Mrs. Mary A. Monteith, A.B. | *Laboratory Technician* |
| J. L. Moore, M.S. | *Assistant, Dairy Section* |
| W. J. Peterson, Ph.D. | *Associate, Head, Nutrition Section* |
| G. Howard Satterfield, M.A. | *Associate, Biochemistry* |
| F. W. Sherwood, Ph.D. | *Associate, Nutrition* |
| F. H. Smith, M.S. | *Assistant, Nutrition* |

## BOTANY

| | |
|---|---|
| B. W. Wells, Ph.D. | *Head of Department* |
| [1]D. B. Anderson, Ph.D. | *Associate, Plant Physiology* |
| D. E. Ellis, M.S. | *Assistant, Vegetable Diseases* |
| S. G. Lehman, Ph.D. | *Associate, Cotton Diseases* |
| L. W. Nielsen, Ph.D. | *Assistant, Potato and Fruit Diseases* |
| [1]K. J. Shaw, M.S. | *Associate, Tobacco Diseases* |
| Luther Shaw, Ph.D. | *Associate, In Charge, Plant Pathology* |
| [1]T. E. Smith, Ph.D. | *Associate, Tobacco Diseases, Oxford, N. C.* |

## EXPERIMENTAL STATISTICS

| | |
|---|---|
| Gertrude M. Cox, M.S. | *Head of Department* |
| R. L. Anderson, Ph.D. | *Assistant, Economic Statistics* |
| [6]A. L. Finkner, M.S. | *Agricultural Statistician* |
| [6]W. A. Hendricks, M.A. | *Agricultural Statistician* |
| [6]R. J. Monroe, B.S. | *Assistant, Biological Statistics* |
| J. A. Rigney, M.S. | *Associate, Biological Statistics* |

## HORTICULTURE

| | |
|---|---|
| M. E. Gardner, B.S. | *Head of Department* |
| [1]Chas. T. Dearing, B.S. | *Associate, Grape Investigations, Willard, N. C.* |
| [4]J. L. Etchells, M.S. | *Assistant, Bacteriology* |
| Ivan D. Jones, Ph.D. | *Associate, Biochemistry* |
| E. B. Morrow, M.S. | *Associate, Small Fruits* |
| G. O. Randall, M.S. | *Associate* |
| Von Harvey Underwood, B.S. | *Assistant, Truck Crops* |
| C. E. VanDeman, B.S. | *Assistant, Pomology* |
| Otto Veerhoff, Ph.D. | *Associate, Physiology* |
| J. G. Weaver, M.S. | *Associate* |
| C. F. Williams, M.S. | *Associate, Small Fruits* |

## POULTRY

| | |
|---|---|
| R. S. Dearstyne, M.S. | *Head of Department* |
| C. H. Bostian, Ph.D. | *Associate, Genetics* |
| H. C. Gauger, M.S. | *Assistant, Bacteriology* |
| R. E. Greaves, M.S. | *Assistant, Serology* |
| D. W. Gregory, M.S. | *Assistant, Hematology and Pathology* |
| Reinard Harkema, Ph.D. | *Assistant, Parasitology* |
| J. J. Hutchinson, B.S. | *Assistant, Poultry Breeding* |
| W. B. Nesbit, B.S. | *Assistant, Turkey Research* |

## RURAL SOCIOLOGY

| | |
|---|---|
| C. Horace Hamilton, Ph.D. | *Head of Department* |
| Harriet Herring | *Associate, Rural Industries* |
| S. H. Hobbs, Ph.D. | *Associate, Land Tenure* |
| S. C. Mayo, Ph.D. | *Assistant, Community Organization* |
| R. B. Vance, Ph.D. | *Associate, Population* |
| Sanford Winston, Ph.D. | *Associate, In Charge, Rural Leadership Research* |

## SOIL RESEARCH LABORATORY, WILMINGTON, N. C.

| | |
|---|---|
| L. G. Willis, M.S. | *Director, In Charge* |
| G. A. Herring, Jr. | *Assistant* |

## ZOOLOGY AND ENTOMOLOGY

| | |
|---|---|
| Z. P. Metcalf, D.Sc. | *Head of Department* |
| B. F. Coon, Ph.D. | *Assistant, Entomology* |
| B. B. Fulton, Ph.D. | *Associate, Entomology* |
| C. F. Smith, Ph.D. | *Associate, Entomology* |
| Merle Wing, B.S. | *Assistant, Entomology* |

### CENTRAL STATION

| | |
|---|---|
| R. J. Harris | *Assistant Director In Charge* |
| J. P. Ammerman, Jr. | *Foreman, Animal Husbandry* |
| Lonnie Griffin | *Herdsman, Animal Husbandry* |
| L. Y. Parker | *Foreman* |
| J. S. Shears | *Herdsman, Dairy* |

### DAIRY RESEARCH FARM, STATESVILLE

| | |
|---|---|
| B. F. Mills | *Foreman* |

### McCULLERS BRANCH STATION

| | |
|---|---|
| J. L. Rand, A.B. | *Assistant Director In Charge* |

### [5]SOIL CONSERVATION EXPERIMENT STATION (NEAR RALEIGH)

| | |
|---|---|
| T. L. Copley, M.S. | *Project Supervisor* |
| Luke A. Forrest, M.S. | *Assistant Soil Conservationist* |
| Sidney H. Usry | *Assistant Agriculture Engineer* |
| I. J. Jackson, Jr. | *Farm Foreman* |

## BRANCH STATIONS†

### BLACKLAND BRANCH STATION, WENONA, N. C.

| | |
|---|---|
| [3]J. L. Rea, Jr., B.S., M.Agr. | *Assistant Director In Charge* |
| Herbert Allen | *Foreman* |
| [2]Dempsey Allen | *Herdsman* |

### LOWER COASTAL PLAIN BRANCH STATION, WILLARD, N. C.

| | |
|---|---|
| [1]Chas. T. Dearing, B.S. | *Assistant Director In Charge* |
| C. O. Bollinger | *Poultryman* |
| [3]E. W. Faires, B.S. | *Assistant, Dairying Bureau of Dairy Industry, U.S.D.A.* |
| D. P. Southerland | *Foreman* |

### MOUNTAIN BRANCH STATION, SWANNANOA, N. C.

| | |
|---|---|
| Dean W. Colvard, M.S. | *Assistant Director In Charge* |
| S. M. Correll, B.S. | *Dairy Herdsman* |
| J. E. Love | *Poultryman* |
| W. M. Whisenhunt | *Foreman* |

### PIEDMONT BRANCH STATION, STATESVILLE, N. C.

| | |
|---|---|
| [1]J. W. Hendricks, B.S. | *Assistant Director In Charge* |
| [1]R. E. Stitt, M.S. | *Assistant Agronomist, Bureau of Plant Industry, U.S.D.A.* |
| [1]R. H. Tilley, B.S. | *Assistant, Cotton Breeding, Bureau of Plant Industry, U.S.D.A.* |

### TOBACCO BRANCH STATION, OXFORD, N. C.

| | |
|---|---|
| [1]E. G. Moss, B.S. | *Assistant Director In Charge* |
| [1]K. J. Shaw, M.S. | *Associate, Tobacco Investigations, Bureau of Plant Industry, U.S.D.A.* |
| [1]T. E. Smith, Ph.D. | *Associate, Tobacco Investigations, Bureau of Plant Industry, U.S.D.A.* |

## UPPER COASTAL PLAIN BRANCH STATION, ROCKY MOUNT, N. C.

| | |
|---|---|
| **R. E. CURRIN, JR.** | *Assistant Director In Charge* |
| **WM. ALLSBROOK** | *Foreman* |

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†The six branch station farms are owned and operated by the North Carolina Department of Agriculture, and the employees on these farms are members of the Department of Agriculture staff.

[1] In cooperation with Bureau of Plant Industry, U.S.D.A.

[2] In cooperation with Bureau of Animal Industry, U.S.D.A.

[3] In cooperation with Bureau of Dairy Industry, U.S.D.A.

[4] In cooperation with Bureau of Agricultural Chemistry and Engineering, U.S.D.A.

[5] In cooperation with Soil Conservation Service, U.S.D.A.

[6] In cooperation with Agricultural Marketing Service, U.S.D.A.

[7] In cooperation with Tennessee Valley Authority.

# AUDITOR'S CERTIFICATE

We, the undersigned, certify that the receipts and expenditures shown in this report from Federal funds and as offset to Bankhead-Jones funds are correct; that the expenditures were solely for the purposes set forth in the acts of Congress approved March 2, 1887 (Hatch), March 16, 1906 (Adams), February 24, 1925 (Purnell), May 16, 1928 (Hawaii), February 23, 1929 (Alaska), March 4, 1931 (Puerto Rico), June 29, 1935 (Bankhead-Jones Title I), June 20, 1936 (Alaska), and March 4, 1940 (Employer Contributions to Retirement); that the expenditures are in accordance with the terms of said acts so far as applicable to this station; and that properly approved vouchers are on file for all expenditures.

| | FEDERAL FUNDS | | | | | Bankhead-Jones Offset |
|---|---|---|---|---|---|---|
| | Hatch | Adams | Purnell | Bankhead-Jones | Total Federal Funds | |
| Balance from preceding year | None | None | None | None | None | |
| Receipts from the Treasurer of the United States | $15,000.00 | $15,000.00 | $60,000.00 | $106,085.56 | $196,085.56 | |
| Receipts from sources within the State | ......... | ......... | ......... | ......... | ......... | |
| Total | $15,000.00 | $15,000.00 | $60,000.00 | $106,085.56 | $196,085.56 | $199,930.33 |
| Disbursements | 15,000.00 | 15,000.00 | 60,000.00 | 106,085.56 | 196,085.56 | 199,930.33 |
| Balance June 30, 1942 | None | None | None | None | None | |

We further certify that the sum of $ None was the total amount earned as interest on the deposit of Hatch, Adams, Purnell, and Bankhead-Jones funds and that this amount has been remitted to the Treasurer of the United States through the U. S. Department of Agriculture.

(Signed) L. D. BAVER,
*Director of the Experiment Station*
J. G. VANN,
*Assistant Controller*

ATTEST:
L. D. BAVER,
*Custodian of the Seal.*

# FINANCIAL STATEMENT

The following is a certified statement of the receipts from the Treasurer of the United States and sales from the Station farms, with a record of their disbursements:

| | FEDERAL FUNDS | | | |
|---|---|---|---|---|
| | Hatch Fund | Adams Fund | Purnell Fund | Bankhead-Jones Fund |
| **Dr.** | | | | |
| To receipts of the Treasury of the United States, as per appropriations for fiscal year ended June 30, 1942 | $15,000.00 | $15,000.00 | $60,000.00 | $106,085.56 |
| **Cr.** | | | | |
| Personal services | 11,150.00 | 12,942.23 | 43,193.28 | 82,430.14 |
| Supplies and materials | 618.86 | 624.10 | 5,849.03 | 9,237.59 |
| Communication service | 265.92 | 26.95 | 403.97 | 255.08 |
| Travel expenses | 914.91 | 458.93 | 4,239.47 | 4,169.23 |
| Transportation of things | .85 | .28 | 22.17 | 238.56 |
| Printing or duplicating and illustrating publications | 1,511.81 | | 1,382.79 | |
| Heat, Light, Water, and Power (Service) and Fuel | | 1.00 | 349.68 | 677.80 |
| Contingent expenses | | | 673.40 | 28.34 |
| Equipment | 537.65 | 694.16 | 3,745.84 | 7,947.62 |
| Land (purchase and rent) | | | | 1,044.95 |
| Structures and non-structural improvements | | 252.35 | 140.37 | 56.25 |
| Total | $15,000.00 | $15,000.00 | $60,000.00 | $106,085.56 |

Interest earned on Federal funds given above, during the period indicated, aggregating—NOTHING—, was covered by check No. —NONE—, drawn by —xxx—, to the order of the Department of Agriculture, to be deposited in the United States Treasury.

## North Carolina Agricultural Experiment Station
## In Account with Farm and Miscellaneous Receipts

**DR.**

| | Total |
|---|---|
| General Fund | $154,904.94 |
| Special endowments, industrial fellowships and similar grants | 16,466.60 |
| Receipt from sales | 28,558.79 |
| Total | $199,930.33 |

**CR.**

| | |
|---|---|
| Personal services | $ 89,879.56 |
| Supplies and materials | 25,419.92 |
| Communication service | 1,789.87 |
| Travel expenses | 9,806.94 |
| Transportation of things | 237.12 |
| Printing or duplicating and illustrating publications | 500.00 |
| Heat, light, water, and power (service) and fuel | 2,127.53 |
| Contingent expenses | 1,084.71 |
| Employer contributions to retirement | ........ |
| Equipment | 27,907.32 |
| Land (purchase and rent) | 17,525.75 |
| Structures and non-structural improvements | 17,220.83 |
| Unexpended balance | 6,430.78 |
| Total | $199,930.33 |

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THE AGRICULTURAL EXPERIMENT STATION
OF THE
NORTH CAROLINA STATE COLLEGE OF AGRICULTURE AND ENGINEERING
AND
NORTH CAROLINA DEPARTMENT OF AGRICULTURE, COOPERATING
L. D. BAVER, DIRECTOR
STATE COLLEGE STATION
RALEIGH